

101 Ways to use barcode in your teaching*

<http://www.barcodeclass.com>



Rev 09/09

*Well, not quite that many, but we're working on it!

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Quick Start

1. Unpack just the barcode scanner. Leave everything else in the box for now.
2. PC/Windows with a PS/2 keyboard and connector: Unplug your keyboard from the back of your computer. Get your barcode scanner and notice that there are two plugs on the cable coming from it, one male and one female. The male plug is the one with pins sticking out of it (see Figure 1). Plug this male connector into the same plug on the back of your PC that you just unplugged your keyboard from. Lastly, plug your keyboard into other (female) connector on the barcode scanner's cable.

3. Macintosh or PC/Windows with a USB port: Get your barcode scanner and notice that there are two plugs on the cable coming from it. Plug the male connector (the one with the pins sticking out of it, see Figure 1) into the USB adapter cable. The adapter cable has two possible plugs. The male barcode scanner plug is to go into the plug on the USB adapter cable that either has a small picture of a keyboard engraved on it, or says the word "keyboard" on it. The color of the correct plug is usually purple. Next, plug the USB connector on the adapter cable into any available USB port.



Figure 1: A PS/2 keyboard connector.

USB users only

When you first plug in your barcode scanner, your computer might pop open a window that says something about detecting a new "USB device" or something similar. These messages are not important since your barcode scanner is identical to a keyboard. Simply close or cancel any such windows as needed and note that you do not need any new drivers, etc. You should convince the computer that the barcode scanner is nothing more than a standard USB keyboard. Generally either clicking "Cancel" or "OK" to default suggestions by the computer will work.

4. Run an application like Word, Excel, Notepad, TextPad, etc. or any other application that you normally type directly into, that will immediately show you what you are typing on the screen.
5. Grab anything around you with a barcode on it. Press the trigger button on the barcode scanner. Red light should emerge from the open end of the barcode scanner. Touch this end to barcode you wish to scan. The barcode scanner should emit a short "beep" and a long number, which is what the barcode is to represent, should appear in the window of the application you ran (step 4).
6. The barcode scanner behaves like a keyboard; that is, the information it compiles from scanning a barcode is sent to your computer as if it was typed from a keyboard. Your computer cannot tell the difference between a barcode scanner and a keyboard.

Quick Concepts

What is a barcode? A barcode is a printed symbol consisting of black and white bars of varying widths. The entire pattern of black and white bars precisely matches one and only one many-digit number. This package uses a barcode format that represents, in particular, 12-digit numbers. There are about 20 other barcode formats.

What does a barcode scanner do? A barcode scanner shines light of a particular color down on a barcode. It has a small digital camera inside of it that is made to respond to light of the same color. Since more light reflects off of the white bars than the black, an image of the barcode can be formed onto the camera. Once the image is formed, a small computer inside of the barcode scanner translates the pattern of bars into the correct 12-digit number the barcode represents. The translation is quite good; an error occurs only about once in every million scans. The barcode scanner will emit a short beep when it has successfully recognized and translated a barcode.

How does my computer use the barcode scanner? When connected, the computer cannot tell the difference between the barcode scanner and a keyboard. When the 12-digit number is compiled by the barcode scanner, it is sent to your computer as if it was typed from a keyboard. The barcode scanner cleverly "fakes" electrical signals to fool your computer into thinking the scanned numbers were typed from a keyboard. This is a very nice feature. Since the barcode scanner is indistinguishable from a keyboard, no special drivers, hardware, or interfacing is needed. It makes setting up a barcode scanner as simple as plugging it in!

How does this help me as a teacher? A 12-digit number can represent one-trillion different number combinations. This is enough to assign a unique number to every person on Earth, many times over. We've written software that takes the 12-digit numbers produced by a barcode scanner and interprets them to be things like student names, multiple-choice quiz answers, grading help, point assignments, and many other "items" that are useful to teachers. If the retail and shipping industry can use barcodes to track their prices and packages, you can certainly use them to track your students!

How do I scan a barcode? As a customer, you've seen retail clerks scan products with a barcode scanner at the cash register. You'll be doing exactly this. With the barcode scanner in hand, press the trigger button and touch the open area of the scanner (where the red light emerges) onto a barcode. In most cases, the barcode scanner will actually have to touch the paper on which the barcode is printed. When you hear a short "beep," it means the barcode has been successfully scanned, decoded, and sent to the computer. You'll quickly get the "feeling" for doing this. Here's a few things to remember:

- When scanning a barcode, keep at it until you hear the beep, then move on.
- Better quality barcodes scan almost immediately.
- Poor quality ones might take up to a full second before being recognized (if at all).
- You can scan a barcode from a right-side-up, or up-side-down orientation.

More "Quick Start" Exercises

Exercise 1

This is an exercise in creating, printing, and scanning your own custom barcode.

1. Go to this page: <http://barcodeclass.com/barcode>
2. Make up any 11-digit number you wish and type it into the topmost box.
3. Type in any text you wish.
4. Leave the scale at 50.
5. Click "Create Bar Code."
6. Print the generated barcode on your printer.
7. Run some application on your computer that you can type into, like Word, Excel, Textpad, or Notepad.
8. Scan the barcode you just printed with the barcode scanner. The 11-digit number you typed at #2 (above) should appear on the screen, as if you typed it into the application itself.

Congratulations! You've just created and scanned your own barcode!

For printing barcodes, we highly recommend a laser printer. (The quality of ink jet printers is a bit broad; some print barcodes of sufficient quality, others do not.) The bars of your printed barcode should be very sharp and crisp with no blurring in between. We have been using a low-cost HP1200-series laser printer and have found it to print barcodes with excellent scan-quality.

This is an important test for your printer. If you can print a scan-able barcode with your printer, then you are all set. The barcode scanner should recognize your barcode almost instantly. If not, you might have to find a better quality printer to use.

Exercise 2

This is an exercise to show you how to print and use a barcoded answer sheet, that can be used to administer a multiple choice assignment.

1. Go to this page: <http://barcodeclass.com/answersheet>
2. Type 15 for "Number of questions."
3. Leave the "Height of the barcode symbol" at 20.
4. Type 4 for "Choices per question."

5. Click "Submit."
6. Print the resulting sheet.

Now, pretend you are taking a multiple choice exam. Bubble, check, or place an "X" in one letter box per line (later this might be an answer sheet submitted by a student.) With some typing application (again) running on your computer (Word, Excel, Notepad, Textpad, etc.), take your barcode scanner and scan each of your bubbled answers. How fast can you scan all answers? This is how long it will take you to grade a real answer sheet submitted by a student. Later (see Section 4), you'll see that the computer can keep track of right versus wrong answers, and the assignment of points to the proper student.

Next, turn to page 10 in the booklet that came in the same small box with your barcode scanner. Scan over the very top barcode labeled "CONTINUOUS MODE." After you do this, the light on the barcode scanner should remain on. This means that you do not have to press the trigger button on the barcode scanner before scanning a barcode; simply touch the barcode scanner over a barcode, and it will scan it. Try scanning the bubbled answers from your answer sheet again. Can you do it even faster than before? On page 10 of the booklet, scan over the "**TRIGGER MODE**" barcode to return the barcode scanner to its original configuration.

Exercise 3

Let's do something a bit different now. It involves installing the barcode software on the CD-ROM that was shipped to you.

Place or insert the CD-ROM into your CD-ROM drive. The software is installed by copying (dragging) the appropriate folder on the CD-ROM (Windows or OSX) to some convenient location on your computer (the desktop perhaps).

Before you start, collect a few (4-6) containing a 12-digit barcode. The barcodes on the items should resemble this one:



Notice there are 12 digits, and longer bars (vertically) on the left, right and middle portions of the barcode. This type of barcode is called "UPC" for "Universal Product Code." It is the kind used by the retail industry in the United States. This particular barcode encodes the number "123456789012." Such barcodes are found on items purchased at a grocery or other retail-type store. There are several different

barcode formats; our system is programmed to recognize just the UPC-type barcodes. So collect items purchased in a grocery/retail-type store for this part.

Here's the next exercise to try:

1. Run the software by double clicking on the "barcodeclass" icon that appears in the folder you put on your computer (from the CD-ROM).
2. Pull down the "Mode" menu and select "Scan freely."
3. Describe the scan as something like "my first barcodes."
4. Assign 1 point per scan.
5. Now, scan the barcodes on the grocery store items you have.
6. Scan as many barcodes as you can. Scan a few individual barcodes more than once.
7. Pull down the "Reports" menu and select "Browse Data."
8. Click the "Show data" button on the windows that pops up.
9. All of the barcodes you scanned will appear in the data list; the software has kept track of all of the barcodes you have scanned.
10. Now pull down the "Reports" and "Histogram" option. Select the appropriate assignment in the drop down box at the top of the window that will open up.

With the assignment selected, you will be shown a bar graph (histogram), illustrating the number of times a given barcode was scanned. Suddenly scanning barcodes might begin to sound useful! For instance, instead of scanning the barcodes on grocery store items, the barcodes might have been printed next to answers your students selected on an in-class quiz or homework assignment. The histogram would be a "snapshot" of their answers, which you can instantly interpret and adapt your class to accordingly; you've just done learning assessment, complete with a full report!

On the histogram, if you'd like to assign more convenient meanings to your barcodes, do this:

1. Pull down the "Create" menu and select "Barcode meanings..."
2. For the 11-digit barcode, type (or scan) the barcode to which you'd like to assign a meaning. (Although a barcode represents 12 digits, we are only free to choose the first 11.)
3. Now, describe what you would like the barcode to mean. For example, say you had a "Roaring Springs Composition Notebook" with the barcode "070972774759." You could describe it as such using this window.
4. Click "Add"

Now pull down the "Reports" and "Histogram" menu again and have the same histogram redrawn. The

bar that corresponds to scans over the notebook's barcode will now be properly labeled. In your teaching, the barcode will more likely be related to some answer the student had to choose from.

Hopefully an in-class idea has come to you. You can use this page: <http://barcodeclass.com/barcode> to create your own barcodes, each corresponding to some idea related to your class. These barcodes can be (copied and pasted) or (saved and inserted) into a word processing document of your design.

This can be helpful for a variety of assessment purposes. For example, suppose you are teaching a science class and want to quiz your students on the number of forces acting on a ball in free-flight. Using the web page at <http://barcodeclass.com/barcode>, you can make a barcode for each possible answer. Perhaps a barcode for zero, one, two, three, and four (forces). Create an answer sheet for your students by inserting the barcodes into a document and arranging them in a useful format, etc. Tell the software what each barcode represents, by using the "Create→Barcode meanings..." Next, at the appropriate time in your class, ask your students the question and give them your barcoded answer sheet. You can scan in their answers, right in class. The histogram will represent an instant "snap shot" of your students' understanding.

Notice the histogram window has a "barcode prefix" selector. This allows you to ask for a histogram created from input (barcodes) that all start with a specific set of digits in the first 3 positions (from the left) of the barcode. This is useful because it allows you to organize input from students for multiple questions at a time. For example, on your barcoded answer sheet, you could prefix all answers to question #1 with the digits "001," and those to question #2 with the digits "002." You can then see histograms made only from input with the 3-digit prefixes that you have chosen. This allows you generate a histogram made from answers that pertain only to a particular question.

Afterthoughts

Hopefully the exercises above have given you a taste of what you can do with barcodes, as they relate to your teaching duties. The sections that follow outline several classroom- and teaching-related areas that are particularly well suited for use with barcodes.

Section 1: Software configuration

There are two computer elements to using the barcodeclass system.

- The first is our website at <http://www.barcodeclass.com>. Many "mechanical" aspects of using barcodes, such as creating barcodes or assigning barcodes to students are handled by the website. Throughout this document, using the website will be referred to as "**the barcodeclass.com website.**"
- The second is the software that runs on your Windows or Macintosh computer. This software does not require the Internet and is standalone software that was delivered to you on a CD-ROM. This software is the key computer element that interfaces with the barcode scanner and is what makes barcodes useful to you as a teacher. Throughout this document this software will be referred to as "**the barcodeclass software.**"

At this point we recommend that you create accounts for yourself on both the barcodeclass.com website and the barcodeclass software, as described below. This only has to be done once, and is part of getting started with the barcodeclass system.

1.1 The barcodeclass software: Create an account for yourself

To start, let's get the barcodeclass software ready to go. Place or insert the CD-ROM into your CD-ROM drive. The software is installed by copying (dragging) the appropriate folder on the CD-ROM (Windows or OSX) to some convenient location on your computer (the desktop perhaps). The barcodeclass software can be run by double clicking on the barcode icon that appears in the folder.

The software is organized by two hierarchical attributes, first by a teacher's name and second by a class that belongs to that teacher. When the software is first run, it automatically starts using a fictional teacher named "Guest Teacher." If you will be the only one to ever use the software on the computer on which it is running, then you are free to simply continue using this generic account and skip to Section 1.2. Read on to create a personal account for yourself (which is what we recommend).

To begin, run the barcode software that you just installed by double clicking on the barcode icon. A main window will pop up with the words "Ready." in a big white box. Pull down the "Teacher" then "Create a new teacher account..." menu. Fill in the blanks with your name, the way you'd like to be referred to by the software.

Next, select your name next to the "Who are you?" label in the new window that pops up. Since you won't have any classes created for yourself yet, select the "Create a new class" option and click "OK."

A new window will pop up. In in, type a class name in the "Class name" box, like "ENGLISH 101" or "History period 1." You'll see and use this description quite a bit as you use this software, so it should be as short (but useful) as possible.

When you complete these steps you'll have an account with the software that you should always "log on" to whenever you run the software in the future. That is, you should always return to the "Teacher" menu and select the "Teacher login..." option. This allows you to tell the software who you are, so your class information can be organized accordingly. You can always create new/additional classes under your name using this menu. Other teachers who might use this software can create accounts for

themselves to keep their incoming data organized.

After you've created an account for yourself, the barcode software is now ready for use.

1.2 The barcodeclass.com website: Create an account for yourself

1. Go to this URL with your web browser: <http://barcodeclass.com/teacher>
2. Create an account for yourself by filling in all three boxes and end with clicking on the "Create new account" button at the bottom.
3. Follow the links, which includes personalizing your account somewhat.
4. At the "Teacher Menu" click "Create a class"
5. Describe the class for which you'd like to start using barcodes (at this point, probably the same class you described in the last section).
6. Keep your browser open for now; you'll come back to the website later on.

<p>Do you have a question or would you like to discuss this section with someone? Email us at: barcodeclass@gmail.com</p>

Section 2: Issuing barcodes to students

As you will find, issuing each student in your class a unique barcode can help in a variety of student identification tasks, such as in taking attendance or in identifying a student paper while grading. The barcode, in effect, acts like a unique (and scan-able) identification number for each student. There are two methods you can choose from that will assign each of your students a unique barcode.

Privacy and Barcodes

Barcode identification numbers for students are also handy for privacy reasons. In effect, they are a unique identification number that only you have assigned to each of your students. The barcode numbers will naturally be different than their social security number or school-assigned identification number. This eases security concerns for you, while also being a wonderfully anonymous and hard to trace number. It makes posting grades or sharing class results easier and more secure.

2.1 Method #1: Have the students get a unique barcode themselves.

With this method, the students are responsible for obtaining a barcode from the barcodeclass.com website.

1. Log on to the barcodeclass.com website (if you are not already) and click on the "Instructions" link under an appropriate class name which falls under the "Your classes" header. You must have created a class for yourself (see Section 1.2) before this link will appear.
2. What is shown is a set of instructions that tells a student how they can obtain a unique barcode for themselves. You should give these instructions to your students. In a nutshell, the instructions tell each student to click to the website <http://www.barcodeclass.com/student>, and create an account for themselves. The website will issue them a unique barcode, which they can print and bring to class. Also, as your students login, a barcoded roll sheet will be compiled for you, which you may access from your teacher account on the website.

At this point, we'd like to encourage you to "be a student" in your own class. Follow the instructions retrieved in Step 2. Get (and print) a student barcode for yourself (following the instructions discussed in #1 above), then return to your teacher account and see how your barcoded roll sheet is built up, starting with you.

When your students are all done obtaining barcodes (perhaps you'll give them a deadline to do so), you can click on the "Barcoded roll sheet" link under the "Teacher Menu" to get a printable roll sheet of your students, with their unique barcode.

Students will typically have a wide variety of printers. Some will print adequate barcodes, other will not. Be a bit careful and realize that you might have to print a class-set of barcodes yourself, on a higher quality printer, that you can then distribute to your students. You can always print a class-set of barcodes using the "Barcode IDs" link under a given class, on your barcodeclass.com account.

2.2 Method #2: You enroll your students and create barcodes for them

This method allows you to enroll your students, and have unique barcodes assigned to each. Your

students do not have to go to the barcodeclass.com website.

1. Click on the "Group Enroll" link under the class name which falls under the "Your classes" header. You must have created a class for yourself (see Section 1.2) before this link will appear.
2. In the big text-box that appears, type your students' names, one per line, in the format of

last-name, first-name

For example if you wanted to register a student with the name of "John Tomato" you would type **Tomato, John** on a line by itself (press [Return] after each line). You might very well be able to paste an entire class list into this box from some other computerized source of your class enrollment.

3. As needed, continue typing in each student's name, one per line.
4. When done, click the "Enroll" button.
5. Follow the links. When you return to the main "Teacher Menu" click on the "Barcoded roll sheet" link. You'll get a printable roll sheet of your students, with their unique barcode.

2.3 Tell the barcodeclass.com software about your students and their barcodes

You now need to tell the barcodeclass software about the barcodes that have just been assigned to your students. Note that until this point, all barcode assigning and student enrolling has been done on the barcodeclass.com website; the software doesn't "know" any of this information. The following steps are now needed to load the student information into the barcodeclass software, so when you scan a student barcode, it can immediately be associated with a student name.

1. On the barcodeclass.com website, under the appropriate class, click on the "Students/barcodes" link which will fall under the "Your classes" header.
2. In the text box that will come up, you'll see each of your student names, and the barcode number they've been assigned. The text should be formatted as

last-name, first-name, barcode-number;

Each line will be followed by a semicolon. Do not edit the text in this box in any way.

3. Click into this text box, select all of the text and copy it to the clipboard (by pulling down the Edit→Copy menu on your web browser).
4. Run the barcodeclass software. Log on ("Teacher" menu and select the "Teacher login..." option) and select the appropriate class.
5. Pull down the "Manage" then "Student Enrollment..." menu.
6. A window will pop up with two boxes of information. The top box allows you to type in the names of students that you wish to enroll with the software. The lower box tells you which

students are already enrolled into the software.

7. Paste the names and barcodes you cut from the website (step #3) into the top box. Each name should appear on a line by itself. Each line should end with a semicolon.

8. Click the "Enroll" button. The students will be enrolled. The barcode scanner will now be able to recognize your students by their barcodes.

2.4 Now for a bit of fun

The steps you have just completed need to be done once per class. That is, once barcodes have been issued to your students via the barcodeclass.com website, and once you have enrolled the students into the barcodeclass software, you do not have to repeat these procedures again.

Try this:

1. If you haven't done so already, print a barcoded roll sheet for yourself from the barcodeclass.com website. Login to the barcodeclass.com website, and for the appropriate class click the "Barcoded roll sheet" link. Print this using your browser's "Print" menu (File→Print).
2. Run the barcodeclass software, log on properly as a teacher, and select the class which corresponds to the roll sheet you have just printed.
3. Using your barcode scanner, scan the barcode next to a name on the barcoded roll sheet. You should see the student's name appear in the main window. The software has recognized the student by barcode.

To see how barcoded attendance works:

1. Pull down the "Mode" then "Take attendance" menu option.
2. Type in some number of points you'd like to assign for this mock attendance record.
3. Next, scan some student names in from the barcoded roll sheet.

The computer will log students you scan as "present" and assign them the given number of points. The next section will formally present you with two methods of taking class attendance using barcodes.

4. To get a report of the mock-attendance you've just taken, pull down the "Report" and "Export class data to CSV." Next, give the software a file name to send a report into. The file that gets created can be imported directly into a spreadsheet program (like Excel or OpenOffice Calc) for further processing. You can also load the report into a word processor like Word, OpenOffice Write, Windows Notepad, or Macintosh Textpad.

Do you have a question or would you like to discuss this section with someone?
Email us at: barcodeclass@gmail.com

Section 3: Taking attendance using barcode

To take class attendance using barcode, each student in your class must have a unique barcode. See Section 2 for instructions on how to do this.

To take attendance, run the barcodeclass software, log on as a teacher, then pull down the "Mode→Take attendance" menu. In the window that pops up, type in some number of points you'd like to assign for this attendance.

The Points to Assign

The number you type is meant to be points, but can mean just about anything to you. For each student you scan, the number you type will be attached to their name in the class record that you can later retrieve. You might type a "1" into the box indicating "present," a number you can reconcile with your overall grading plan later on. Students who are not scanned in (e.g. are absent) will be given a "0" by the software.

The software is now set, and you may begin taking attendance. There are two scenarios that work particularly well for taking class attendance using barcode.

3.1 Your students do each have a printed barcode with them

The first scenario assumes that each student has a printed barcode in their possession. Students may obtain a barcode in two primary ways:

- They can print barcodes for themselves by logging onto the website and clicking the "See your barcode" link (see Section 2).
- Alternatively, you can issue each student a printed barcode by logging on to the barcodeclass.com website, clicking the "Barcode IDs" link, and printing the resulting page(s) that come up. Barcodes can be cut from the resulting print-outs with a paper cutter, for instance, then distributed to students.

You should encourage students to always bring their barcode to class with them. We have found it ideal to have students tape their barcode to the back of their notebook, for instance.

With your barcode scanner ready, have your students walk by you, one-by-one, as they enter (or leave) class. Have them show you their barcode as they walk by. Scan it and move on to the next student. The software will diligently assign the set number of points to each student you scan. It will give zero points to students who you do not scan (those that were absent). After you scan the last student's barcode, you are done taking attendance. The software will have already compiled an attendance record which you can later retrieve.

3.2 Your students do not each have a printed barcode with them

The second scenario allows you to take roll from a barcoded roll sheet. You can always print a barcoded roll sheet for your class by clicking on the "Barcoded roll sheet" link on your account at the barcodeclass.com website. As you determine if a given student is present (you see the student in class, or call out their name, etc.), scan the barcode next to their name. The software will assign the said number of points to each student as you scan their name. Repeat this for all students, and then you are

done taking attendance. The software will compile an attendance log which you can later retrieve.

3.3 Obtaining Attendance Reports

The software will provide you with a complete attendance report. Here's how:

- Pull down the "Reports→Export class data to CSV" to export the data to a file that can be imported into Word, Excel, or some other software you might use to keep track of your grades. Your students' names will be listed in a downward vertical column at the left. Across the top row will be a column-by-column list of all attendance sessions you've done. At the intersection between a student's name and an attendance session will be the number of points a student received for that attendance session.
- Pull down the "Reports→Browse data" menu, then click the "Show data" button to see an exhaustive list of all barcodes scanned for attendance (among other things).
- Pull down the "Reports→Export Assignment Data" menu. Select the name of an attendance session for which you are interested in seeing a report, then click "Export." Tell the software about a file you wish to create. When the file is created, load it into a text editor like Word, Textpad, or Notepad. It will contain a student-by-student breakdown of attendance for that attendance session.

3.4 Remarks

The attendance taking mode of this package works particularly well for college classes where taking attendance is typically not done after the first day of class. Attendance for a class of 30-ish students can be taken in under a minute, as students enter or leave a class.

If you'd like to take attendance in this manner *and* have your students submit answers to some kind of out-of-class quiz or assignment, see Section 8.

Do you have a question or would you like to discuss this section with someone?
Email us at: barcodeclass@gmail.com

Section 4: Grading multiple choice exams or assignments using barcode

You are probably familiar with having students "bubble in " answers on a pre-printed answer sheet in response to a set of multiple choice questions. To grade the answer sheet, you feed the answer sheets through a grading machine, which prints the number of correct answers somewhere on the answer form for you to later process. Some machines will output results to a floppy disk for you to import into your computer.

Administering and grading multiple choice assignments using barcode is similar in theme to the "bubble form" approach you're already used to, but offers a number of advantages:

- You can design and print your own answer sheets. Students can also print their own answer sheets.
- Points based on correct or incorrect answers are automatically tracked and tallied by the computer. During the grading process, all you do is scan answers; the computer does everything else (tally points, record scores, etc.).
- You grade the sheets yourself with the barcode scanner; you don't need to have or find a grading machine.
- Results can be immediately shared with students via the barcodeclass.com website.
- Telling the computer whose paper you are grading is as easy as scanning a student's barcode (from your barcoded roll sheet, or from the student's barcode which can be printed on the top of the answer sheet).

4.1 Getting ready

First, write your exam as usual, and keep in mind that a barcoded answer sheet is limited to five (5) maximum answers (A, B, C, D, and E) per question. This limitation is due to the width of the paper and the minimum size of a scan-able barcode. More options are possible, but a wider paper format will be needed (landscape printing for instance).

Second, go to the page <http://www.barcodeclass.com/answersheet> and fill out the form. You might return to this page a few times until your answer sheet appears as you need it to. Whatever answer sheet you end up with is what each student will need to have during your multiple choice assignment. Try to print your original barcoded answer sheet on a good quality laser printer. Copies of a barcoded answer sheet, produced by a good quality copy machine will work just fine.

Check the quality of your answer sheet

There can be issues with the quality of a printed barcode and the spacing between the barcodes themselves. Before you use an answer sheet, see how easy it is for you to correctly scan barcodes. Is the print quality sufficient for the barcode scanner? Are the barcodes spaced far enough apart so that you can always scan the code you intend to scan? Run a word processing program (like Word, Notepad, or Textpad) that will display the barcode you scanned. Try randomly scanning the barcodes on a blank answer sheet. Try to get a feeling for how well the answer sheet will interface with the scanning process.

Third, you have to tell the barcodeclass software what the correct answers are to your assignment, and

how many points correct answers are worth, so it can help you grade them. Here's how:

1. Run the barcodeclass software and log on to your teacher account.
2. Pull down the "Create→Multiple choice assignment..." menu.
3. In the window that pops up, give the assignment a name.
4. Into the "Answer string" box, type in the correct answers, one after another, separated by commas. For example, if you are giving a 3 question exam, and the answer the #1 is A, #2 is C, and #3 is D, you'd type **A,C,D** into the "Answer String" box..
5. Type the number of points each correct answer is worth into the "Points Worth" box. Type each point value one after another, separated by commas. So, if the correct answer to #1 is worth 2 points, that for #2 is worth 1 point, and that for #3 is worth 5 points, you'd type **2,1,5** into this box.
6. You can preview the answer/points worth correspondence by clicking the "Preview" button. If everything looks OK, then click "Ok."

You are done for now. Administer your assignment, telling the students to use the barcoded answer sheet. Tell them to bubble (check or X-out) their answers, being careful not to make any marks on the barcodes themselves.

4.2 Grading the completed answer sheets

To grade the completed answer sheets:

1. Run the barcodeclass software and log on to your teacher account.
2. Pull down the "Mode→Grade multiple choice assignment..." menu.
3. Select the appropriate assignment, by name from the list box, and click "Ok."
4. Place a completed student answer sheet in front of you. Begin by scanning the student's name, most likely from your barcoded roll sheet. This tells the computer whose paper you are about to grade.
5. Now, grade the student's answers by scanning each of the answers the student has selected (bubbled). Answers may be scanned in any order, and the computer will tell you if you've scanned an answer more than once.

As you scan, the computer will always show you an on-screen, up-to-date tally of right versus wrong answers and points earned. When done with a given answer sheet, get the next answer sheet, scan the next student's name and repeat step 5.

A tip with the barcode scanner

You might find it helpful to turn to page 10 in the booklet that came with your barcode scanner. Scan the top code, labeled "CONTINUOUS MODE," which will leave the barcode scanner's light on. In this mode, all you have to do is "touch" each selected answer with the barcode scanner to grade it (you don't have to press the trigger button each time). The normal mode of the barcode scanner can be returned to by scanning the "TRIGGER MODE" barcode.

4.3 Seeing your student's results

When you have completed grading all answer sheets you can see how your students performed. Here's how.

- Pull down the "Reports→Histogram" menu. Select the assignment whose results you wish to view from the drop down box at the top of the window that will pop up. You can see the results of different questions by clicking on the "Previous" and "Next" buttons.
- Pull down the "Reports→Export class data to CSV" to export the data to a file that can be imported into Word, Excel, or some other software you might use to keep track of your grades.
- Pull down the "Reports→Browse data" menu, then click the "Show data" button to see an exhaustive list of all responses.
- Pull down the "Reports→Export Assignment Data" menu. Select the assignment name and click the "Human readable" option and click "Export." Tell the software about a file you wish to create. After the file is created, load it into a text editor like Word, Textpad, or Notepad. It will contain a problem-by-problem breakdown of how each student did on the multiple choice assignment. You could paginate this document, so each student's report is on a page by itself, and hand each page back to the corresponding student.

4.4 Individualized student answer sheets

Although you (the teacher) can certainly be in charge of creating and distributing answer sheets, there are two other options.

1. When students log in to their personal accounts on the barcodeclass.com website, they each have a "Get an answer sheet" link. (As a teacher, we hope you created a "student" account for yourself, as outlined in Section 2.1. If you did, you should investigate this link using your "student" account.) This link offers the student the option of printing a 10 or 20 question answer sheet, that *prints their name and barcode at the top of the answer sheet*. When you grade their answer sheet later, you can scan the student's barcode right at the top of the answer sheet they submitted. This is a very quick and convenient way of identifying a student paper during the grading process.
2. You can also print individualized answer sheets using your teacher account. Under the appropriate class, click on the "Manage Students" link. Next to each student's name are links enabling you to print both 10 and 20 question answer sheets, personalized (by name and barcode) for each student.

Do you have a question or would you like to discuss this section with someone?
Email us at: barcodeclass@gmail.com

Section 5: Getting assistance grading a stack of papers

Suppose you have a stack of papers to grade. This can be a stack of exams or a collected homework assignment, among others. In a typical case, there are several "free-response" type questions, to which the student has formed an answer that you are to grade.

When grading such an assignment, you must perform many tasks. First and foremost, you must determine what point value a student should receive for their work. Second, you must record the number of points a student should receive for each part of a question. For example, on problem #1, you might have determined that the student should earn:

- 4 points for part 1a,
- 2 points for 1b, and
- 3 points for 1c.

Third, you must add the points given for each part of the problem to determine how many points per problem were earned (9 points total for this hypothetical problem #1). Fourth, you must add the points earned per problem to determine the number of points earned on the entire assignment or exam. Fifth and finally, you must record the final grades in your grade book. So, apart from evaluating their work, there are 4 other tasks you must perform on each paper, none of which have to do with pedagogy! Often times, this results in flipping through a stack of papers multiple times.

Grading a stack of papers using the barcodeclass software and a bit of preparation can eliminate the four "extra" steps entirely, allowing you to focus your grading effort solely on the pedagogical aspects; the barcodeclass software will handle the rest. Here's how this works.

5.1 Work out your grading rubric

For each question on your assignment or exam, determine what maximum number of points a student can earn for their answer. Next, determine what points you are willing to give for an answer, from 0 to the maximum possible. For example, a problem might be worth a maximum of 5 points, and you might be willing to assign 0, 1, 2, 3, 4, or 5 points on the problem, or you might only be willing to assign 0, 2, or 5 points. Figure this out for each answer on the assignment or exam.

5.2 Tell the Barcodeclass software about your rubric

Next, pull down the "Create→Grading Assistant..." menu. Briefly describe what the grading job is, like "Exam over Unit 2," and how many total points the grading job is worth. A message box will confirm the creation of your grading assistant. A window will then pop up titled "Add Grade Assist Barcode." With this window, you tell the software about the grading rubric for each problem you assembled in Section 5.1.

The "Describe this answer" box should be the name of the answer whose rubric you are now entering, like "1a" or "Essay #2" or "Problem 2, part c." Fill in the maximum points the answer is worth and a list of individual points values you are willing to assign for the answer. Don't forget to include zero (0) points in your list of points values. Fill in point values in the text box all in a single line, with points separated by commas. When done, click the "Add tag" button.

Repeat this for all problems on your assignment. Your rubric will appear, one by one, in the box in the

lower part of the window. Don't click "Done" on this window just yet.

5.3 Print your barcoded rubric

The last step is to get a printout of your barcoded grading plan so you can use it while you grade your stack of papers. This is handled by the barcodeclass.com website.

On the same window that you've been using to add your rubric, there's a button called "Export tags." Click this button, and you will be prompted for a file name that your rubric will be saved to. Go ahead and select a file and allow your rubric to be saved. Next, using your web browser, go to the URL **<http://www.barcodeclass.com/gradeassist>**. Click on the "Choose File" button and select the same file you just saved from the barcodeclass software. For now, leave the "Format:" as "Individual barcodes." Click the "Submit" button.

What you'll see in your browser will be a barcoded version of the grading rubric you assembled as described in Section 5.2. You should see each of your assignment's problem's listed in a bold heading. Beneath each heading will be a barcoded representation of the possible points you specified. Print the entire barcoded rubric using your browser's "File→Print" function.

5.4 How to use all of this to grade your papers

Before grading your papers, get these three things together.

- A barcoded roll sheet for your class.
- The printed barcoded grading rubric from Section 5.3
- Your stack of papers.

Spread the roll sheet and grading rubric out in front of you. Run the barcodeclass software, login to your teacher account, and pull down the "Mode→Grading Assistant" menu. Get the first student's assignment. Scan their name off of the barcoded roll sheet so the software knows whose paper you are grading. Begin grading the paper as you normally would, in particular, determining how many points the student is to receive for each answer. As you come to your point determination, scan the number of points you have decided to give from the barcoded grading rubric. Be sure to scan the right barcode under the right problem. The software will immediately recognize the problem and give the said number of points to the student whose name you scanned. At this point you are done with that answer for this student and do not have to return to it again.

Go to the next answer, determine how many points the student is to receive, scan the correct barcode on your barcoded grading rubric, and continue until you are done with the student's assignment. Select the next student's paper, scan their name from the barcoded roll sheet, and begin determining and scanning point values as before.

Notice what you ARE NOT DOING: You ARE NOT adding point values together; you ARE NOT recording grades. YOU ARE spending most of your time evaluating your students' work. The tedious aspects of grading has disappeared. YOU ARE saving time.

You can retrieve a full grading record by pulling down the "Reports→Export Class Data to CSV" which will save a file on your computer that can be loaded into a spreadsheet directly, or into a text or word processing program for direction viewing.

5.5 Formatting the Grading Rubric

The printed grading rubric can be poorly formatted, depending on how many answers you are grading. It is difficult to control where a browser will paginate a long printout, which can make for an awkward printed grading rubric.

If you return to the URL <http://www.barcodeclass.com/gradeassist>, there are two "Format" options, "Individual barcodes" and "Paneled barcodes." You've already used the first option and have seen how it works. In essence, the barcoded rubric is simply "dumped" into your browser for printing; little formatting options are available.

The "Paneled barcodes" option creates a panel of point values to assign for each problem. A "panel" is a single image in your browser, with each panel (or image) representing the barcoded rubric for exactly one entire answer. If you had 6 answers to grade, for instance, there would be exactly 6 images (or panels). Such images are easy for you to import, copy, or drag into a word processing document (e.g. Word, OpenOffice, Pages, etc.), in order to create a barcoded grading rubric whose format better suits your needs.

5.6 What to give to your students

If you did nothing but scan barcodes, you might not have written anything with your red pen on the students' papers. How are they to know how they scored on each problem? Pull down the "Reports→Export assignment data" menu. In the window that pops up, select the name of the assignment you just graded. Check the "Human readable" box and click "Export." The software will ask you for a file name to save the grading records to. Give it one and when done, open the resulting file into a word processor (Word, Notepad, Textpad, etc.) The file will contain a student-by-student, problem-by-problem report on exactly how many points you gave for each answer. If you put a page break between each student's report, you can print the entire document and give each student the page or pages relevant to their work. Each student can receive a neatly printed, unambiguous record of how their answers were graded!

You can also share grading results with your students over the web. Section 9 explains how to do this.

Do you have a question or would you like to discuss this section with someone?
Email us at: barcodeclass@gmail.com

Section 6: Assigning points with barcodes

You assign points to students for a variety of reasons: in-class participation, extra credit, special projects, grading-as-usual, etc. This can be done using the barcode software simply by telling it how many points you wish to assign and to whom they should be assigned.

To begin, run the barcodeclass software and log on to your teacher account. Identify the field in the main window labeled "Point value." This field will always represent the number of points the software is ready to assign.

Next, Pull down the "Mode→Give points" menu. In the window that will pop up, describe what the points are for, and how many you'd like to start assigning. Lastly, tell what is the maximum number of points you will assign. The software treats assigning points like an assignment itself (which typically has a maximum number of earnable points).

When you click "Ok," the window will disappear and the "Point value" field in the main window will reflect the current number of points that will be assigned to the next scanned student. In other words, to assign that number of points to a student, simply scan the student's barcode.

Section 6.1: Changing the number of points to assign

The initial window above gave you a chance to enter a number of points to assign. You can change the number of points to assign to the next student(s) as follows.

- Any barcode that starts with a "98" is recognized as a number of points to assign. The 9 digits following the "98" are the number of points. So, 9800000001 would tell the software to assign 1 point. Likewise, 9800000019 would mean to assign 19 points. This means you can use the single barcode creation tool at <http://www.barcodeclass.com/barcode> to create a barcode for each number of points you intend on assigning. Create a document (with your word processor) that includes the barcodes. Print it, and use it as your "paper keyboard" to select how many points you wish to assign.
- You can use the tool at <http://www.barcodeclass.com/points> to automatically create a series of point-assignment barcodes, if you have a defined range of point values that you wish to assign.

In sum, when in "Give points" mode, the software will always assign the number of points shown next to the "Point value" label to the student whose barcode you scan. So if you have 3 students to whom you wish to assign 5 points, set the "Point value" field to "5" by scanning the appropriate barcode, then scan the 3 students' barcodes. They will all be assigned 5 points. If a 4th student comes along and should be assigned 3 points, set the points to assign to "3" then scan the 4th student's barcode.

Section 6.2: Reports

Getting a report about what points you assigned can be done in a variety of ways.

- Pull down the "Reports→Histogram" menu and select the name of the point collection session. You'll see a histogram of the points you assigned.
- Pull down the "Reports→Export Assignment data" menu and select the name of the point

collection session. Checking "human readable" will generate a report suitable to give to each student. Unchecking this and selecting an option for barcode translation will generate a rawer report, showing all point values assigned and to whom.

Do you have a question or would you like to discuss this section with someone?
Email us at: barcodeclass@gmail.com

Section 7: Miscellaneous scanning and tracking of barcodes

The barcodeclass.com package can be a tremendous help in probing your students' knowledge *during class*. One might call this "real-time" assessment. In use, you ask students a few questions, right in class, about any relevant course material, and give them some time to work on the questions (right in class). The trick in effectively doing real-time assessment, however, is to be able to rigorously analyze your students' answers and get a meaningful report very quickly, so you can adapt your class accordingly. Some of the ideas here are motivated by a concept called "Peer Instruction," outlined at this website:

<http://mazur-www.harvard.edu/research/detailspage.php?ed=1&rowid=8>.

The use of the barcodeclass system described in this section is similar to the use of hand-held "clickers" that you might have seen before. They are somewhat like television remote controls, one issued to each student in a class, for in-class voting-type exercises (see h-itt.com and einstruction.com).

7.1 Doing anonymous real-time, in-class assessment

In implementation, a small number of questions (between 2 and 5) are put in front of the students. The classroom setting is kept informal, unlike the formal exam period. You can ask your students to work on the questions either by themselves or in discussion-oriented groups. Discussion with the instructor and fellow students is particularly encouraged. Multiple choice questions are the best to use since they are the most easily graded, so you should make an appropriate multiple choice answer sheet at this page:

<http://www.barcodeclass.com/answersheet>.

Set a strict time limit for your students to work on the questions, so you won't consume too much valuable class time. You can give students a few multiple choice questions BEFORE your lesson-plan, after your lesson-plan, or even before AND after (in which case you can compare results to help gauge the effectiveness of your pedagogy).

Tell your students to bring up their completed answer sheet *as soon as they finish*, as opposed to at the end of the allotted time. This way, completed answer sheets will trickle in, a few at a time. Run the software, log in, and pull down the "Mode→Scan freely" menu. Describe what you are scanning and set a point value for each scan. Stand ready with your barcode scanner to quickly scan in answer sheets as your students bring them up.

As your students begin work on the questions, you will get a steady stream of answer sheets coming in during the exercise. Quickly scan the answers selected by your student as you receive their completed answer sheets. Note that this is an anonymous exercise, so you are not scanning any student barcodes for identification purposes. Scanning answer sheets for all students in a class works best for classes with no more than 40 students. With more students, consider forming groups, with each group turning in a single answer sheet (representing the answers for the whole group).

When all answers have been scanned, you can get a graphical report by pulling down the "Reports→Histogram" menu and selecting the appropriate assignment. Answers to particular problems may be histogrammed by selecting the appropriate "barcode filter" from the drop down box at the bottom of the histogram window. At this point you can interpret the results, share them with your students, and potentially adapt your lecture to address trends in the results.

7.2 Doing real-time, in-class assessment with student identification

If you'd like to tie in-class assessment results to individual students (to work some accountability into it all), then you'd simply use a (short) multiple choice assignment (see Section 4) as your in-class assessment vehicle. So, keeping everything else the same, you'd start your scan session by pulling down the pull down the "Mode→Grade multiple choice assignment" instead of the "Mode→Scan freely" menu. Be sure to have a barcoded roll sheet (see Section 3.2) nearby so you can scan a student's name in, to identify them, as they bring up their completed paper. You can also use individualized answer sheets as described in Section 4.4.

An instant report is always available by pulling down the "Reports→Histogram" menu. You can also pull down the "Reports→Export assignment data" to get a list of your students and what answers they chose.

7.3 Freely scanning barcodes

The final use of barcodes we'll document here is a bit opened ended. It simply records any barcode you scan and creates a histogram, showing the number of times a given barcode was scanned. To use this mode, pull down the "Mode→Scan Freely" menu. Describe the barcodes you are about to scan and how many points each should be worth. Now, just start scanning barcodes, assuming you have created a printed set of barcodes that are useful and meaningful for your purposes (use the barcode creation tool at <http://www.barcodeclass.com/barcode>).

At any time you can get a report about your scans:

- Pull down the "Reports→Histogram" menu to see a graphical report about your scans.
- Pull down the "Reports→Export assignment data" to get a list of barcodes you scanned that can be imported into Word, Excel, or some other application for further use.

You can also give your own meanings to barcodes, since 12 digit numbers are difficult to interpret. To do so, pull down the "Create→Barcode meanings" menu. In the top line, type (or scan) a barcode to which you'd like to attach some meaning. Type the meaning into the next box. You can see your collected of defined barcodes in the lowest box. Your barcode meanings will show up in reports, on the histogram bars, and in data browsing.

In general, barcodes you're interesting tracking can be created one-by-one at the page <http://www.barcodeclass.com/barcode>. Barcodes can then be cut or copied from the web page, into a word processing document, formatted as needed.

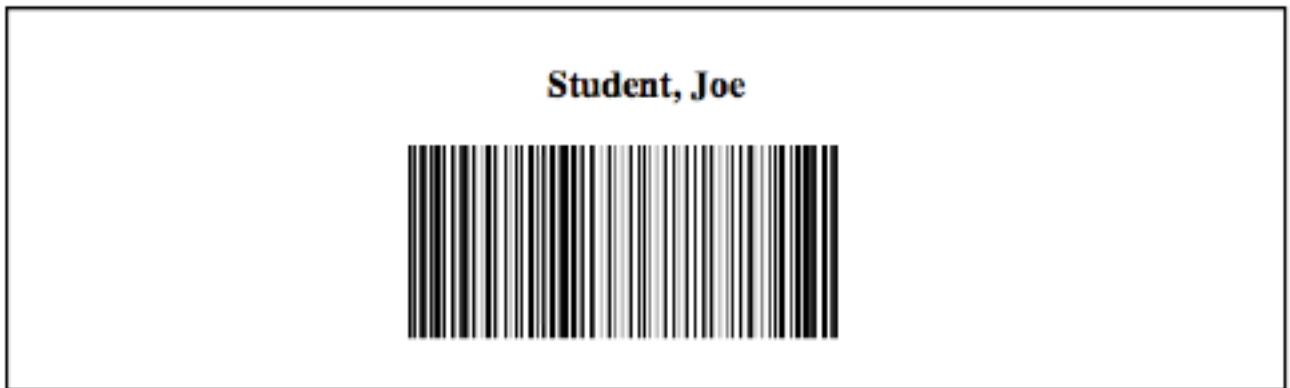
Surveys and general observations are probably the best use of this mode of collecting barcodes. One of our customers uses barcodes to record activities chosen by teachers in a teacher-training series of workshops. In a science section, a barcode is scanned for each teacher that chooses to work on a "solar energy" unit. Another barcode is scanned for each teacher who works on a "geology" unit.

Do you have a question or would you like to discuss this section with someone?
Email us at: barcodeclass@gmail.com

Section 8: Grading quizzes by scanning a single barcode ("one-scan" grading)

8.1 Introduction

The following might look like nothing more than a student's name above a barcode.



But it contains much more information than that. The barcode itself is coded to contain two bits of information:

1. The student's identification.
2. The answers they've selected for a 10 question, multiple choice quiz.

If this barcode is scanned, the computer would do two things:

1. Identify the student that is submitting the barcode.
2. Grade the student's encoded answers, assign points based on correctness, and enter the total points into your class record under the student's name.

We call this "one-scan" grading because you are effectively grading and recording an entire quiz by scanning one barcode per student. One-scan grading is ideal for short, out-of-class quizzes or assignments that the student must turn in at a future class meeting.

Uses of one-scan grading

This is a quick, paperless way of administering and grading a short multiple choice assignment or quiz.

Want to motivate your students to prepare for class? Give them a pre-class quiz. Issue a quiz prior to your class (post it online, on your bulletin board, etc.). Ask your students to generate a barcode similar to the one above, print it, and bring it to class. As the students walk into class, scan their barcodes. The computer will grade their quiz, record their score, and you can optionally tell the software to take attendance from the same barcode as well.

8.2 Prepare your quiz

To begin using one-scan grading, write a multiple choice assignment or quiz with up to 10 questions. Each question can have answer choices from A to J.

Next, tell the barcodeclass software what the correct answers are to your assignment, and how many points correct answers are worth. This is identical to the procedure outlined in Section 4.1 (on multiple choice assignments). Here's how to do this:

1. Run the barcodeclass software and log on to your teacher account.
2. Pull down the "Create→Multiple choice assignment..." menu.
3. In the window that pops up, give the assignment a name.
4. Into the "Answer string" box, type in the correct answers, one after another, separated by commas. For example, if you are giving a 3 question exam, and the answer the #1 is A, #2 is C, and #3 is D, you'd type **A,C,D** into the "Answer String" box..
5. Type the number of points each correct answer is worth into the "Points Worth" box. Type each point value one after another, separated by commas. So, if the correct answer to #1 is worth 2 points, that for #2 is worth 1 point, and that for #3 is worth 5 points, you'd type **2,1,5** into this box.
6. You can preview the answer/points worth correspondence by clicking the "Preview" button. If everything looks OK, then click "Ok."

You are done for now. This is most likely going to be an out-of-class assignment, since each student needs a computer on which to generate their answer barcode. Issue the quiz or assignment to your students using some convenience delivery mechanism (on paper, online, email, etc.)

8.3 What your students need to do

Using "one-scan" grading requires each of your students to have an account on the barcodeclass.com website (see Section 2). Assuming this is true, here's what your students must do:

1. Work the quiz or assignment and when they have their answers, to log on to the barcodeclass.com website at **<http://www.barcodeclass.com/student>**. After logging on, they should click on the "Create an answer barcode" link.
2. Tell the computer what answers they'd like to select for each question, from A-J, using the drop-down boxes.
3. Click the "Take my answers" button. A barcode, similar to the one above will be generated and displayed in their browser window. They should print the page and turn it in to you according to your instructions.

8.4 What you (the teacher) needs to do

Run the barcodeclass software and log on to your teacher account. Pull down the "Mode→One-scan grading" menu. Select the one-scan assignment you wish to scan and if the computer should also take attendance with each barcode you scan (if so, type the number of points attendance is to be worth).

Now, simply scan each barcode presented to you by your students. The computer will grade their answers, record point totals, and take attendance (if required). Note that this can be done from a stack of collected barcodes at a later time, or real-time, as students present them to you in class. Scanning them real-time eliminates an entire stack of papers for you to manage.

Since the identification part of a one-scan barcode can substitute a student's personal barcode (normally used for attendance), you can really perform two actions in a single scan: take attendance AND grade their answers all at once. This might very well encourage students not only to come to class, but to come to class prepared!

If you normally take attendance with barcodes, and a student has come to class without their special one-class barcode, you can scan their normal attendance-only barcode (see Section 3) and the system will give them points for attendance, but no points for the multiple choice assignment.

8.4 Seeing your student's results

When you have completed scanning all one-scan barcodes, you can see how your students performed, as follows:

- Pull down the "Reports→Histogram" menu. Select the assignment whose results you wish to view from the drop down box at the top of the window that will pop up. You can scroll through the answer by clicking on the "Previous" and "Next" buttons.
- Pull down the "Reports→Export class data to CSV" to export the data to a file that can be imported into Word, Excel, or some other software you might use to keep track of your grades.
- Pull down the "Reports→Browse data" menu, then click the "Show data" button to see an exhaustive list of all responses.
- Pull down the "Reports→Export Assignment Data" menu. Select the assignment name and click the "Human readable" option and click "Export." Tell the software about a file you wish to create. When the file is created, load it into a text editor like Word, Textpad, or Notepad. It will contain a problem-by-problem breakdown of how each student did on the multiple choice assignment. You could paginate this document, so each student's report is on a page by itself, and hand each page back to the corresponding student.

You can also share results with your students over the web as described in Section 9.

Section 9: Tracking what your students do in class

You might have a need to keep track of things your students do while in class. Some examples might include:

- Excessive talking in class.
- Remembering to bring their book.
- Forgetting their calculator.
- Playing with their cell phone.
- Entering or leaving class.
- Sleeping in class.
- Being attentive.
- Etc.

You can keep track of such activities, and the time and date they occurred, very easily using barcode. Here's how.

9.1 Create barcodes

The first step in tracking your students is for you to create a unique barcode for every activity that you wish to track. To do so, go to this web page using your web browser:

<http://www.barcodeclass.com/barcode>

Type in any 11-digit number that you wish; the only restriction is that this number does not start with the digit "9," as this is used for many "fixed" uses of the software, such as student attendance, etc. For example, suppose you wanted to track "forgot their calculator." You might fill in this page as follows:

- For the 11-digit barcode, type: **23423423442** (this is a totally random number).
- For the text to appear under the barcode, type: **Forgot calculator**
- For this, a barcode height of **50** is fine.

When you click the button, a barcode will be sent to your computer. In most cases, the barcode will be immediately displayed. The barcode itself is a small image in PNG format. Save this barcode as a file somewhere on your computer. This will be your unique barcode meaning a student "forgot their calculator." The 11-digit code of **23423423442** is what makes the barcode unique.

Using this same procedure, create a unique barcode for every student activity that you wish to keep track of. Assemble a group of the generated barcode files in a place on your computer where you can find them.

9.2 Create a tracking sheet

Next, open a new document in your favorite word processor, such as Word or OpenOffice Writer. Insert the barcodes you just created, in a neat and usable format. Placing each barcode in the cell of a table, for example, works well, perhaps two barcodes per row. Also, typing an easy-to-read description of each

barcode above or below each will help you to quickly identify each barcode when you use this "tracking sheet." Next, print the sheet, and be sure you can easily scan the barcodes with your barcode scanner.

9.3 Tell the software about your barcodes

Next, you need to tell the barcodeclass software about your barcodes. Run the software and log in to your teacher account. Pull down the "Create→Barcode meanings..." menu. For each barcode you created on your tracking sheet:

- Type (or scan) the barcode into the top box.
- Into the second box, type a convenient description as to what the barcode represents.
- Click the "Add" button.

After all of your tracking barcodes have been added, you are done and ready to begin tracking your students' activities.

9.4 Tracking your students

When you are ready to begin tracking your students, run the barcodeclass software, and log in to your teacher account. Pull down the "Mode→Track students" menu and describe this particular tracking setting. This description is used for your own record keeping later. When you wish to track something a student does:

- Scan the student's barcode from your barcoded roll sheet (See Section 2).
- Scan the activity as needed from your tracking sheet.

That's it! The activity scanned for the student scanned will be inserted (and time-stamped) into your database.

9.5 Seeing what you tracked

You can see what you tracked on your students by:

- Pull down the "Reports→Export class data to CSV" to export the data to a file that can be imported into Word, Excel, or some other software you might use to keep track of your grades.
- Pull down the "Reports→Browse data" menu, then click the "Show data" button to see an exhaustive list of all responses.
- Pull down the "Reports→Export Assignment Data" menu. Select the name of the tracking session you wish to see, and click the "Human readable" option and click "Export." Tell the software about a file you wish to create. When the file is created, load it into a text editor like Word, Textpad, or Notepad. It will contain a student-by-student breakdown of what was tracked for each student.

9.5 Tracking modes

While tracking barcodes, there are three tracking modes that might be useful to you. If you pull down the "Edit→Tracking mode" menu, a window will pop up with the three options. This menu option is not enabled (grayed-out) unless you are in tracking mode. Each of these options will change how the software handles incoming barcodes, while you are in tracking mode. They are as follows.

- **Record student/tracking code pairs (most common).** This is the mode that causes tracking mode to work as has been described thus far. When you scan a tracking barcode, it gets recorded with the currently selected student's name.
- **Remove scanned tracking code for current student only.** When a tracking barcode is scanned, it is *removed* from the record of the currently selected student.
- **Remove scanned tracking code from session.** When a tracking barcode is scanned, it is removed from all records of the currently selected tracking session.

These tracking modes are most useful to update or change information in a tracking session that has already been completed. To "rejoin" an old tracking session for updating, use the "Mode→Rejoin an old session" option, and select the required tracking session. Next, pull down the "Edit→Tracking mode" menu and select a tracking mode, as needed.

As mentioned, the first tracking mode simply attaches tracking barcodes to the currently selected student's name.

The second tracking method (remove tracking code for current student) is useful to *remove* tracking barcodes that were previously scanned and attached to a given student's record. For example, suppose you started a tracking session called "prepared for class," and you scanned for a given student, "forgot their calculator." Later, the calculator was found (at the bottom of their backpack). Here's what you would do:

1. Rejoin ("Mode→Rejoin an old session") the "prepared for class" tracking session if the software is not currently running it.
2. Pull down the "Edit→Tracking mode" option, and select the second tracking method ("Remove scanned tracking code for current student only").
3. Scan the student's barcode ID.
4. Scan the tracking barcode for "forgot their calculator."

This will remove the "forgot their calculator" message from the student's record.

The third tracking method (removing a tracking code from a tracking session) allows for the removal of a tracking barcode with no regard to a particular student's name. When in this mode, the software will search all students for the scanned tracking barcode and remove it from all records *in the selected tracking session only*. This can be useful, for instance, if you have a small classroom library. You can have a unique barcode for each book (these are the "tracking barcodes"). To keep track of who has what checked out, you might do the following:

1. At first, start a new tracking session called "book checkout" using the "Mode→Track students" menu. Later, you'll always want to rejoin this tracking session using the "Mode→Rejoin an old

session" menu.

2. When a student checks out a book, you'd scan their barcode ID, then the barcode of the book. Records will now indicate that the student has checked out the particular book.
3. When the student returns the book, you'd rejoin the checkout "book checkout" tracking session (using the "Mode→Rejoin an old session") menu, then select this third tracking mode using the "Edit→Tracking mode" menu.
4. Scan the barcode for the book. Without any reference to the student, the software will remove any reference to this particular book from the "book checkout" tracking session, indicating that no student currently has the book checked out.

Section 10: High Resolution Grading

10.1 Introduction

You probably grade papers with some kind of colored pen. You grade by reading through your students' work, writing comments and assigning or deducting points as you go. When done, you make another pass through the papers, adding points and determining the final score.

Although this time-tested method works, the constant (and repetitive) writing and point adding is tedious. Often students are left only with two or three word fragments, followed by a number indicating the points lost or earned. Additionally, it is difficult to keep accurate records or trends in the grading. What was the most frequent error made? Second most frequent?

"High resolution grading" allows you to assign a barcode to every possible grading "theme" you identify as you grade a stack of papers. A grading "theme" is a mistake you find in your grading job. If you are grading an essay, for example, grading "themes" might be:

- Illogical conclusion
- Missing introduction or conclusion
- Lacking in organization
- Grammatical error
- Spelling error
- Hard to understand
- Run-on sentence

While grading a physics exam, your themes might be:

- Wrong formula
- Algebraic error
- Poor figure
- Wrong logic
- Incorrect numerical result

As your list of themes grows, and you if you provide highly detailed themes, your students will received equally detailed grading reports on their work. This is what is meant by "**high resolution grading.**"

10.2 Setting up

In the barcodeclass software, pull down the "Create→High resolution grading session" menu. When you do so, a window like that shown below will pop up.



If this is a new high resolution session, give the session a name that you can later refer to. Also fill in the total possible points a student can earn on what you are about to grade. If you are editing a previously configured grading session, use the drop-down box at the very top to select it.

After this, you'll notice that the window has two text boxes to fill in. The leftmost box asks you to "Identify each item you'll grade." Into this box you should type, one per line, each item you will be grading. For example, suppose you are grading an exam with 9 questions. The questions are 1a, 1b, 1c, 2a, 2b, 3, 4a, 4b, and 5. In this leftmost box, you would type these question names, one by one, each on a line by itself. As another example, suppose you are grading an essay, containing an introduction, body, and conclusion. You would type "Introduction" "Body" and "Conclusion" into this box, each on a line by itself.

In sum, the leftmost box is where you identify (by name) each of the individual items you will be grading.

The rightmost box is labeled "Identify each grading theme you are looking for." Into this box, you are to type each grading theme you are looking for, and the number of points that should be deducted from a student's grade if the grading theme is spotted in their work. Recall the grading themes discussed above for the physics exam or essay. Such themes are to be typed into this box.

Each line in this rightmost box is to contain two items, separated by a comma. The first item is the point value that should be deducted if the grading theme is spotted. The second item is the actual grading theme itself.

10.3 An Example

Here is the above box filled in for a 10 question physics exam.

High Resolution Grading

-- This Is a new High-Res. Grading Session --

Session Name: physics exam #1

Total Earnable Points: 100

Identify each item you'll grade:

1a
1b
1c
2a
2b
3
4a
4b
4c
5

Identify each grading theme you are looking for:

2,A - Wrong formula
1,B - Algebraic error
3,C - Poor figure
4,D - Wrong logic
2,E - Incorrect numerical result

Item name
(One per line.)

Point-deduction,grading-theme-you-will-identify
(One pair per line.)

Update Close Export...

Notice all possible problems to grade are listed, one per line, in the leftmost box. The rightmost box contains all grading themes expected on the papers. Note each is prefixed with a code like "A" or "B," creating a grading "legend." If you use such a grading legend, then its symbols are all you need to write on a student's paper, at the spot where the error or mistake was found. For instance, an "B" would be written on a student's paper over the spot where the algebraic error was made.

Finally, note how each line starts with a point value, followed by a comma. The point value as mentioned, is how many points the software will deduct from the student's grade if that particular grading theme is encountered. So the software will deduct 3 points from a student's total grade if the "Poor figure" theme is scanned.

You might find it difficult to anticipate all grading themes you might encounter before you grade your papers. In this case, add several "blank" grading themes after your known themes. You may assign meanings and point values to these blank themes *as you grade*. When your grading job is done, you can return to the configuration window (shown above), to fill in meanings for the blank grading themes (and

their point values). The software will update all student records accordingly. See Section 10.7 for more on this. Also, it is wise to have a "catch-all" grading theme, for student a student error that impossible to categorize.

When everything is done, click the "Update" button to save/update your information.

10.4 Create your barcoded tools

Next, you'll need to create barcoded sheets that allow you to scan items and themes as you grade your papers. Click the "Export..." button, then choose a file to save to. When done, go to this link using your web browser:

<http://www.barcodeclass.com/hires>

Using the buttons, select the file you just saved, then click the "Send File" button. In a few seconds a PDF document will be displayed. The first page (or set of pages) will contain barcode identifiers of the items you will be grading (the names of the problems, like 1a, 1b, etc.). The second page (or group of pages) will contain barcode identifiers for the grading themes you identified. Print all of these pages. You are now ready to begin grading your papers.

10.5 Grade your papers

Get your stack of papers to grade, a barcoded roll sheet (see Section 2), and the two sets of barcoded sheets discussed in the previous paragraph. Using the barcode software, pull down the "Mode→High resolution grading" option. In the window that pops up, select the name of the high resolution grading session you wish to use.

To grade a paper:

1. Get the next paper in your stack, and scan the student's name (so the software knows whose paper you are grading).
2. For the first problem you will grade, scan the appropriate item name on the barcoded sheet of "items" to grade.
3. Read over the student's work. As you spot errors, scan the appropriate grading theme on the "grading themes" print-out. Scan as many themes as needed. Using your legend (if you defined one), mark on the student's paper where the mistake was made, using the appropriate legend symbol.
4. Go on to the next problem. Scan the new problem's barcode so the system knows what problem you are grading. You may also remain on the same problem, but go to another student's paper, in which can you would simply scan the new student's name from your barcoded roll sheet.
5. Repeat steps 1-4 until you are done grading all papers.

10.6 Get a grading report

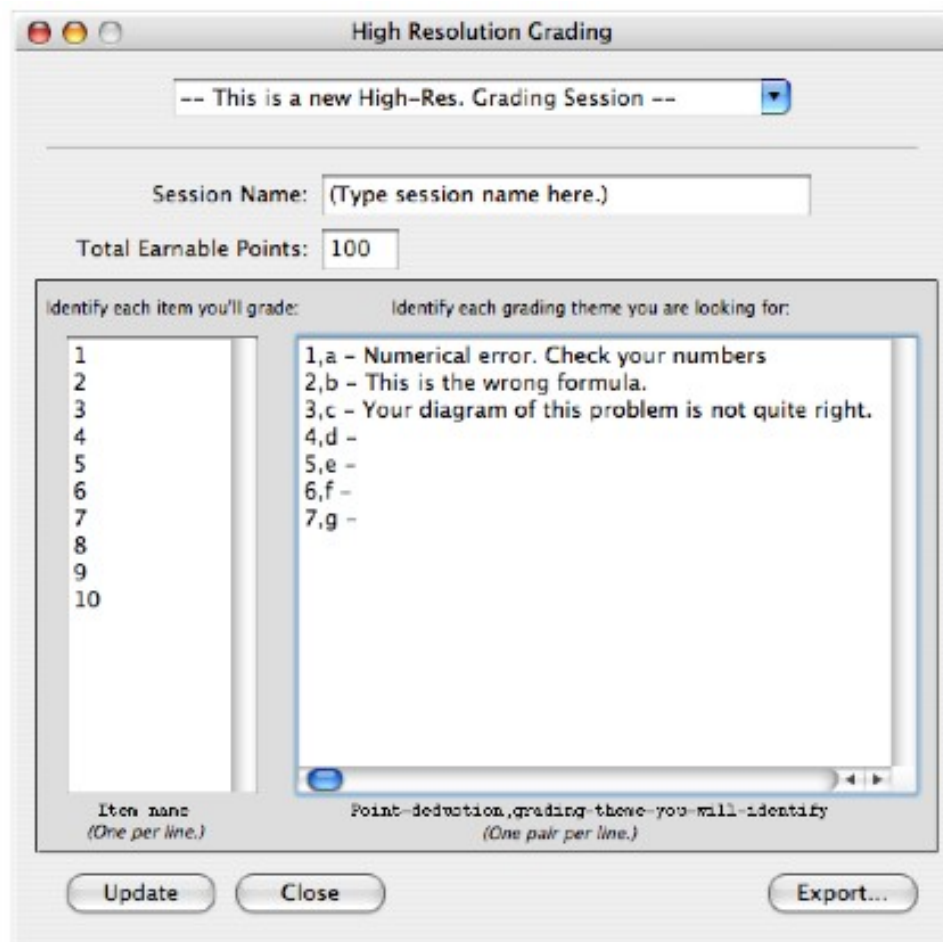
To get a full report of what you just graded, pull down the "Reports→Export Assignment Data" menu.

Select the name of the high resolution grading session you just completed, then a file name to which the report should be sent. Open the report file using a word processor, and you'll see a complete report of all grade deductions, total deductions, and each student's ultimate score. This file may also be readily imported into Excel (as a CSV file) for further processing.

If you insert page-breaks in the document, after each student's section, then each student can be given a printed copy of their grade report. Alternatively, the a grading legend (if used), may be posted for students to see. In this mode, they can "look up" why points were deducted as they were.

10.7 Let your grading themes evolve as you grade

As mentioned above, it is not necessary to anticipate all possible grading themes before you grade your stack of papers. Undoubtedly student errors will surface, of which you did not think beforehand. In this case, we always recommend adding several "blank" grading themes to the end of your list, as shown in this window.



Notice in the rightmost box, that three concrete grading themes (and point values) have been defined. A legend has been defined as well. For instance, "a" written on a student's paper will correspond to a "numerical error." Also notice that there are four "blank" grading themes (legend symbols d - g). As you

grade your papers, suppose you confront a student who uses the wrong units on a number, which eventually leads to an erroneous conclusion to their work. Next to "d" on your printed grading theme sheet, you can handwrite "units error" as you discover this grading theme, scan "d" to connect this theme with the current student. As you continue grading, you would use "d" as a "units error" grading theme, wherever it occurs.

When your grading job is complete, you can return to the window above, edit the grading theme description next to "d" to reflect its definition as a "units error" them. You may also adjust the point deduction value, currently set at "4" to whatever value is needed for a "units error" deduction. When you click the "Update" button, the software will not only update the grading theme definitions, *but all grading data you just scanned for your students*. Meaning, upon clicking the "Update" button, any student that has this "units error" grading theme attached to their name, will have the corrected point value deducted from their grade.

Section 11: Check In/Check Out

If you maintain a small class library, or allow students to borrow items from your class, then the "Check In/Check Out" mode will be useful to you. This mode will help you to keep track of "who has what checked out." Suppose that all of the items that can be borrowed are each uniquely barcoded. When a student wants to borrow something, you'd scan the student's barcode identification, then the barcode of the item they wish to borrow. The system will record their name, along with the item they are borrowing. At any time, you can generate a report to see "who has what checked out."

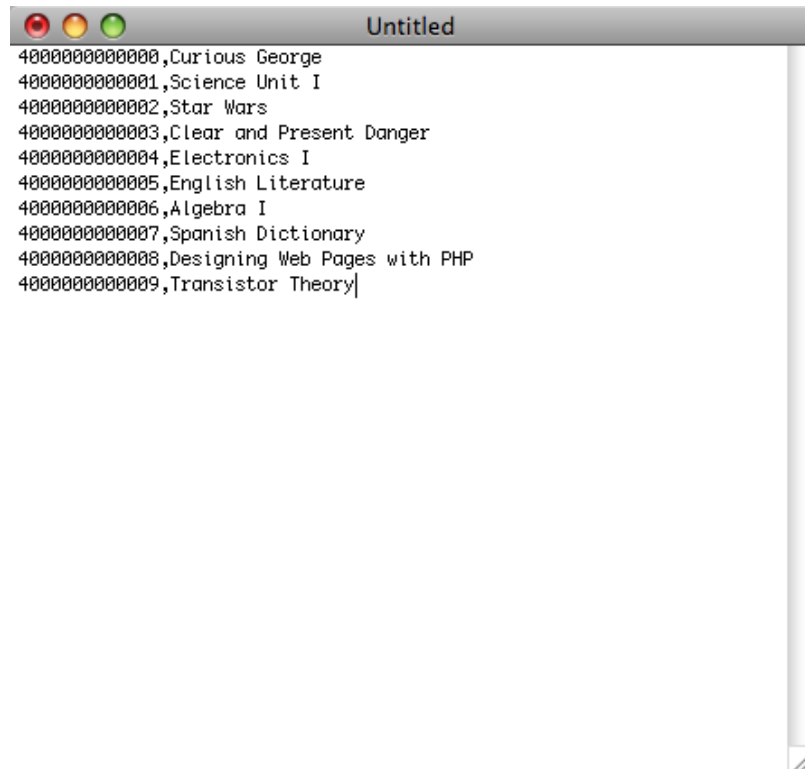
11.1 Barcoding the items to check out

Each item that can be checked out needs to have a barcode attached to it. We offer a tool to make this job easier for you. Here's how.

- To begin, purchase a set of Avery 5160 sticky labels from your local office store. Such a package will have sheets of printable "peel-off" labels, 3 labels per row, with 10 rows per sheet.
- Next, make a file on your computer containing two columns. The left column should be an 11-digit barcode. The right column should be a description of the item that will have this barcode. The number used for the barcode is entirely up to you, as long as it is 11-digits long. You should not start your barcode with the digit "9," since such barcodes are used internally by the software.
- When this file gets saved, be sure that there is a comma between the barcode and description on each row. If you are generating this file in a word processor, then you'll have to put the comma in yourself. If you are generating this file using a spreadsheet (like Excel), then you can instruct Excel to save the file in "CSV" format, which stands for "comma separated values." With this format, Excel will automatically insert a comma between the two columns when you save the file. You can see an example of using Excel for this at this page:

<http://www.barcodeclass.com/excel.html>

- In either case, be sure the file is saved as CSV or in text format, so that it is human readable. A Word **.doc** file, or Excel **.xls** file will NOT work. Here's a sample file containing barcodes and descriptions for 10 books.



Notice that the file is "human readable" text with no special formatting codes. The barcode values themselves are arbitrary; the only requirement is that they're 11-digits long. The file in the figure above was displayed using TextEdit on the Macintosh, similar to Notepad under Windows. You should be able to load and view your file in TextEdit or Notepad to be sure it is truly in human readable (text) format.

- Go to this page using your web browser: <http://www.barcodeclass.com/mass.php>, and upload the two column file you just created. In return, you will be sent a PDF file containing the actual barcodes, that may be printed directly to Avery 5160 labels.
- Place the labels on your items that can be checked out.

Finally, be sure that any student who might use your checkout system has their own barcode identification (see Section 2).

11.2 Telling the barcodeclass software about your checkout items

Next, you need to tell the barcodeclass software about your barcoded items, so that it can identify them. To do so, pull down the "Create→Barcode meanings" menu. Click the button labeled "Add from CSV." **Select the same two column file you used to produce your barcode labels.** After you select this file, the barcodeclass software will process it, and be able to recognize your barcoded items.

11.3 Setting up a Check In/Check Out session

Pull down the "Create→Check In/Check Out" menu. Think of a name that you'd like to collect all of

your check in and check out transaction under. If this is for a class library, you might call this **library** or something similar.

11.3 Performing Check Outs and Check Ins

At this point, your initial set up is done, and you do not have to repeat any of the above steps. To use the system to track your check outs and check ins, do the following. Pull down the "Mode→ Check In/Check Out" menu.

- **If the student is checking an item out:**

1. Scan a student's barcode to identify them.
2. Scan the barcode of the item or items they are checking out.
3. The item(s) will be attached to their name as being "checked out."

- **To check items back in:**

Simply scan the barcode of the item to be checked in. The system will search its internal database for the barcode, and if found, remove it from the student's name to whom it was last checked out.

- **To get a complete check in/check out report:**

Pull down the "Reports→Check In/Check Out Report" then select the name of the session for which you wish to generate a report. Next, select a file to which you'd like to send the report. The report will be saved, and you may view (and print) the report using your word processing program.

11.4 Simple Check In/Check Out mechanism

The Check In/Check Out mechanism in this mode is fairly simple. When you scan the barcode of an item to be checked out:

- If the item's barcode is not found in the internal database, it is attached to the student's name whose barcode ID was last scanned. That is, the item becomes "checked out."
- If the item's barcode is found in the internal database, it will be removed from the student's name that it is attached to. The item becomes "checked back in." This will happen independent of what student barcode ID was last scanned.

Section 12: Sharing grades with your students over the web

As you scan various class and student related information, as described in the preceding sections, you may share results of these scans with your students over the Internet. This is a very convenient way to keep your students actively involved with their grades they are receiving. In order for this to work, three steps needs to be taken by you, followed by your students checking in on their grades.

12.1 Update your barcodeclass.com account

You need to send the grading information, recorded by the barcodeclass software, to the barcodeclass.com website, so it can be shared with your students. Here's how:

1. With the barcodeclass software, pull down the "Report→Export class data for web" menu. The computer will ask you for a file name to save some data to. The data sent to the file you choose will be a web-ready report that consists of all student grading information you have compiled thus far.
2. Upload this file you just saved to the barcodeclass.com website. Log in using your teacher account (<http://www.barcodeclass.com/teacher>) and under the appropriate class, click on the "Web update" link. For the "Select the web-report file to upload" prompt, click the button and select the file you just saved from the barcodeclass software.
3. Click "Update" and you're done. Your grading information has been updated to your barcodeclass.com account. To keep the website up-to-date for your students, you'll have to go through this web update procedure each time you complete a new barcode-based event.

12.2 Have your students click to barcodeclass.com to see their grades

Each student must have had a barcode assigned to them, via the barcodeclass.com website in order for this web-grade-sharing feature to work. You can return back to Section 2 for instructions on how to do this.

- If (see Section 2) students created their own barcodes (Section 2.1), then they are already registered and nothing else needs to be done. Your students may simply log in to the barcodeclass.com website to see their grading information.
- If you created barcodes for your students (Section 2.2) you can still use this feature, but there only one issue. Since you manually registered your students, they won't have any way of logging into the barcodeclass.com website to see the grade information that you wish to share with them. But this information is available; you just have to give it to them. If you log on to the barcodeclass.com website, under your teacher account, there is a "Student logins" link. If you click this, you'll see a four column table. The first two columns are the students' names that you registered and the barcode number that was assigned to each of them. The last two columns are the ones you'll need to share with your students. Privately give each student their "Login name" and "Password" as shown in the rightmost two columns of the table. This is the information they'll need to log on to the barcodeclass.com website and see their grades.

Next, tell you students to go to this page: <http://www.baracodeclass.com/student>. They can log in and click on the "Check your grades" link. When they do so, they'll see a neatly tabulated report of all barcoded grading that you've done thus far. Note that students are only allowed to see grading

information that pertains to them and no one else.

Do you have a question or would you like to discuss this section with someone?
Email us at: barcodeclass@gmail.com

Section 13: Hall pass tracking for your students

Hall passes are special permission slips or badges students must carry to leave a classroom they should otherwise be within. Bathroom breaks, library trips, etc. are typical reasons students leave a room. The barcode software allows you to keep track of when a given student left the room and when they returned.

13.1 Hall pass mode

After running the barcode class software and logging into your proper teacher account and class, pull down the "Mode→Hall pass" menu. This sets the software into "hall pass mode."

13.2 Checking a student out of your class

When a student leaves your room, scan the barcode assigned to them. This may come from a barcode identification they carry around with them, or your own private barcoded roll sheet. Both of these items can be generated from your teacher account at <http://www.barcodeclass.com/teacher>. Once scanned, the software will log the student's name, time of day and internally tags them "out."

13.3 Checking a student back into your class

When a student returns to the classroom, again scan their barcode. The software will log them as "in" and the time and date at which they returned.

13.4 Generate a hall pass report

To see a complete list of all student check-ins/check-outs pull down the "Reports→Hall pass" menu. You'll see a tabulated list of all check ins and outs for the given class, as well as the option of saving the list to a file (into a .CSV file, which can be loaded into a spreadsheet program, such as Excel).

Section 14: Getting reports on your class(es)

The barcodeclass software is not meant to serve as your grade book. Its primary function is to route and store barcodes you scan in a way that will help you in your teaching duties. As far as grade book software goes, there are many fine software packages out there that serve this purpose (a simple Excel spreadsheet would do a better job as a grade book than the barcodeclass software would).

So, in lieu grade book functionality, the barcodeclass software DOES OFFER several ways of getting data out of it and into some other software you can use for further grade book-type processing. All of these options can be found under the "Reports" pull-down menu. What these reporting actions do are summarized below.

14.1 Reports→Browse data

Pulling down this menu brings up a window containing a grid-like structure. Clicking the "Show data" button will tell the software to dig into its internal database and retrieve all barcode scans that are attached to you as a teacher AND the particular class you have selected at log in time. This is a very raw data reporting window. It simply dumps everything you've scanned for you to see. Using the buttons near the bottom of the window, you can do a bit of data maintenance: You can edit (change) a record (a line of data) that was scanned, delete a record or multiple records, or export the entire data set to a disk file for loading or processing with other software.

14.2 Reports→Histogram

This action was referred to several times in the sections above. In a nutshell, this reporting mechanism scans the data attached to a particular assignment that you select. It finds repeated scans of a particular barcode, and counts how many times that barcode occurs in the data. For every unique barcode it is able to find and count, it draws a bar whose length is proportional to the count (or frequency) of that particular barcode. This is, of course, what a histogram is: a graphical representation of how many times a particular item is found to occur in a set of data.

14.3 Reports→Export class data to CSV

This is the most comprehensive method of extracting data from the barcodeclass software: it searches its database for all described scan-sessions (multiple choice grading, point assignments, etc.) for all students in your class and creates a two dimensional grid showing you all of the data it has. Along the leftmost vertical column are your students' names. Across the topmost row are the scan-session names. The area bounded by these two structures gets filled with all of the data. "CSV" stands for "comma separated values" and simply means all columns are separated by a comma. Spreadsheets like Excel or OpenOffice Calc readily import such files in a manner which will properly fill rows and columns of your spreadsheet with the data for further processing.

14.4 Reports→Export class data for web

As described in Section 8, this reporting action will send all of your data for a particular class to one big file on your computer. This file scan then be uploaded to your account on the barcodeclass.com website, in order to share grades with your students.

14.5 Reports→Export assignment data

If you are interested in the data scanned only for a particular named scan-session (e.g. a particular multiple choice assignment, point assignment, etc.), then this final reporting action is what you'll need. It will scour your database for the scans pertaining only to the particular assignment you have selected, and send them, neatly formatted, to the file that you select. The file can then be loaded into a word processing document for viewing, formatting and printing.

Do you have a question or would you like to discuss this section with someone?
Email us at: barcodeclass@gmail.com

Section 15: Closing

This document has attempted to outline the core functionality of the barcodeclass system. Our software- and web-development has been focused on features that seem to work best with barcode.

At this point, we would like to encourage you to try the system! Start simple, perhaps by doing something with barcode that does not involve the students directly. Giving them a multiple choice assignment with a barcoded answer sheet, that you scan and grade outside of class, is a good place to start.

In either case, remember that help or suggestions with this product are both only an email away. Please contact us at **barcodeclass@gmail.com**. We normally answer email within 4 hours, Monday - Friday. Also, if you have an idea for barcodes that our software doesn't seem to do, let us know! We're always interested in expanding and developing our software!