

Scanning tests on colored paper for Gradescope, and other Gradescope issues
Updated for HP fn2 scanner
Glenn Tesler, June 5, 2019

Recommended paper colors

I experimented with settings on our “**HP Digital Sender Flow 8500 fn2 Document Capture Workstation**”, which was installed in the Math Department computer rooms in Summer of 2018, replacing the previous fn1 model. The scanner instructions by John Eggers and Marc Loschen work well for white paper, but I found that other settings work better for colored paper. Also, some settings have changed for the newer scanner model.

UCSD Imprints has 13 available paper colors for 20 lb 8.5”x11” paper. I tried samples of them all with a variety of scanner settings, and used 11 of the 13 paper colors on actual exams.

Recommended paper colors and color combinations for multiple versions:

- **1 color:** White. Most exams are ordered on white paper.
- **2 colors:** White and Canary (light yellow) are cleanest.
- **4 colors:** Blue, Green, Canary, Pink (or substitute Blue, Green, or Pink by White).
 - These are the most popular colors ordered for exams on colored paper.
 - I usually have alternating rows, with one row alternating blue/green and the next yellow/pink.
- **6 colors:** White, Blue, Green, Canary, Pink, Tan
- **If you need additional colors, add:** Gray, Lavender, Buff, Goldenrod, Ivory. However:
 - Gray apparently can be mistaken for white when students turn in exams by color. The white and gray paper may look similar under certain room lighting.
 - Lavender is darker than the rest; it’s legible but on the cusp of what’s useable.
 - Buff and Goldenrod are off-yellow and close to canary, but canary gives cleaner scans.
 - Avoid Ivory unless you really need a lot of colors. The Ivory paper is translucent, so scans pick up the opposite side of the paper. Increasing the **Darkness** setting to pick up light pencil better will increase noise from the opposite side of the paper.
- **Email vs. USB:** Either is acceptable for white paper. For all other colors, a high-capacity USB 2.0 or 3.0 stick is generally better, to avoid splitting scans into multiple files; see later in this report.

Avoid:

- **Buff, Goldenrod, Ivory:** As explained above, only use if you need a lot of colors.
- **Salmon, Cherry:** Too dark.

Other issues:

- The next page lists settings for 2-sided scanning. The back side scans are generally lighter and noisier than the fronts, although this has improved a lot on the fn2 scanner vs. the previous fn1 scanner. There may be better settings for 1-sided only scanning.

HP Scanner Settings with white or colored paper
Glenn Tesler, June 2019 (Updating the instructions from John Eggers and Mark Loschen)
 For more info: <http://math.ucsd.edu/~gptesler> under "Instructor Resources"

1. Sort exams by version and color. Sort each stack alphabetically (to facilitate fixing any scanning/uploading problems later). Separate out any exams with extra pages and scan them individually.
2. Cut off the stapled corners from each exam. Scissors work much better than the guillotine cutter.
3. Scan the exams using an HP scanner in the department printer rooms. The scanner holds batches of ~140 sheets, comprised of multiple students' exams; however, if you use the email option, you may need to use smaller batches (~45 double-sided white sheets, or ~10-20 double-sided color sheets, depending on color) to avoid splitting the file in the middle of an exam. If a batch is split into multiple files, you need to combine them in Adobe Acrobat Pro or other software before uploading to Gradescope.
4. Here are the steps on the HP scanners:
 - a. Press **Scan to Email** or **Scan to USB Drive**.
For Email, fill in the address for To:, and optionally fill in other fields.
 - b. Optionally fill in **File Name**, e.g., "mt2-yellow1", "mt2-yellow2", ..., The scanner has a default filename and adds a timestamp, which may be sufficient for some people.
 - c. Press the **Options** button in the lower left corner.
 - d. Select **Original Sides** and set it to 2-sided. Press **Done** to complete that setting.
 - e. Select **Color/Black** and set it to **Color** or **Black/Gray** (for grayscale) as appropriate.
Avoid **Automatic**; for white paper with color or grayscale writing, it may determine an incorrect setting.
 - f. Select **Image Adjustment** and set the sliders according to the paper color, in the tables below.
"0" = default, "+x" = x notches to the right, "-x" = x notches to the left.

Image adjustment settings for scanning in color				
		Paper color		
	Scale	White	Buff, Goldenrod, Gray, Green, Ivory, Pink, Tan, Yellow	Blue, Lavender
Sharpness	-2 ... 2	2 (all the way right)	2 (all the way right)	2 (all the way right)
Darkness	-4 ... 4	4 (all the way right)	4 (all the way right)	3
Contrast	-4 ... 4	-4 (all the way left)	0 (default)	0 (default)
Background	-2 ... 6	0 (default)	0 (default)	0 (default)

Image adjustment settings for scanning in grayscale				
		Paper color		
		White	Blue, Goldenrod, Gray, Green, Lavender, Pink, Tan	Buff, Yellow, Ivory
Sharpness		2 (all the way right)	2 (all the way right)	2 (all the way right)
Darkness		4 (all the way right)	4 (all the way right)	4 (all the way right)
Contrast		-4 (all the way left)	0 (default)	0 (default)
Background		0 (default)	0 (default)	1

- g. Load a batch into the tray, face up with the clipped corner towards the feeder.
- h. Press the green **Save** or **Send** button in the lower right corner to start the scan. Be careful; this is different than the black **Save** button that may appear on the left for "Quick Sets and Defaults."
- i. For "Do you want to retain settings for the next job?", press **Retain** if you will be continuing.
- j. Repeat (b-i) until all exams are scanned. Any of steps (b-f) can be skipped if the retained settings are suitable, but you may need to change some of them when changing colors.
5. Scan exams with extra pages separately. Try the settings for the main color on the whole test. If the extra pages don't scan well, then scan them separately according to their paper color and combine the files.

Order to upload exams

- If you used email and it split a batch into two or more files, use Adobe Acrobat or other software to merge the fragments of the batch into one file before uploading (rather than uploading the separate fragments).
- In Gradescope, select the assignment (exam) and follow the instructions under Manage Scans
- Gradescope presents exams in the order the scan files are uploaded. To facilitate grading multiple versions as one Gradescope assignment, upload all of one version, then all of the next version, etc. If a version is printed in multiple colors, then upload by color within each version. Graders should be alert to when the version changes.
- Gradescope allows you to start uploading one file while it's still uploading the previous file. However, the 2nd file may complete uploading before the 1st, which will disrupt the intended version/color order. So, upload one file at a time if version/color order is important.
- If any student's exam will not be available until after the rest of the class has been uploaded, you may want to give them the "last" version/color of the exam, since uploading their exam late will put it last in the grading order. Consider this if there are students taking the test separately from the rest of the class whose exams may not be available in time to scan with the others.

Scanning to Email, USB Drive, or Network Folder

Scanned files can be saved to a USB stick, sent by email, or to a network folder. They each have pros and cons. The scanner also can save to SharePoint, but it's not set up in our department.

For scanning **white paper only**, in **stacks of ~90 pages (45 double-sided sheets) or less**, in color or grayscale:

- After scanning, it may take a couple of minutes to process the file. This is a great improvement over the previous (fn1) scanner, which could take over half an hour. With email, you can leave the scanner and wait for the email to arrive, then save it and clear it from your email. With a USB drive, you have to wait a couple of minutes till it finishes before you can remove the USB drive and leave. There's not much time difference any more as compared with the previous (fn1) scanner.

Winner: Tie.

For scanning larger stacks or scanning colored paper, whether color or grayscale:

- **Winner: USB stick. Email is way more tedious.**
- Use a recent, fast, high-capacity USB 2.0 or 3.0 stick, with FAT formatting. My decade-old USB 1.0 stick was painfully slow, while a USB 3.0 stick takes about the same scanner processing time as email.
- A USB stick saves the whole batch as a single file, no matter how large, while email may split the batch into multiple files, which requires additional work after scanning. For email, the scanner splits the output into multiple PDF files approx. ~18-19 MB each, which expand about 35-40% when encoded into an email attachment. The split may be in the middle of an exam booklet, and the file fragments may arrive in email out-of-order. You need to manually put them in order and combine them into a single PDF (e.g., with Adobe Acrobat Pro or LaTeX's pdfpages) before uploading to Gradescope. The amount of time it takes to deal with this greatly exceeds just waiting a couple extra minutes for the scanner to write it as a single file to a USB stick.
- The number of pages per file varies with paper color, scanner settings, and page contents. If you want to use email but avoid the automated splitting, experiment to see how many pages/exams can fit in one file. For my exams, with colored paper scanned in color, roughly 20-40 pages (meaning 10-20 double-sided sheets) fit one email attachment, so this is not as practical as for white paper scanned in grayscale.
- Additionally, sending the files by email can fill up your mailbox (potentially several GB of files as attachments for one exam in classes with 100s of students).

Network Folder:

- Wilson also set up the option for the scanner to upload the files to a network folder, such as a directory on math.ucsd.edu. Request instructions from him if you are interested.
- The steps are rather tedious as compared with the email and USB options.
- There is a danger of filling up the network disk, particularly if many people in the department did this in the same time period (e.g., 10s-100s of GB per day during exam periods), so that would have to be addressed if we were to widely use this option.

Gradescope rosters

The instructions below are for maintaining a Gradescope roster yourself. However, TritonEd has recently added Gradescope support; you must request it for your course (it's not enabled by default) and their instructions say it can take up to two weeks to set up. In addition, TritonEd will soon be replaced by Canvas, and presumably that will have Gradescope support added and new instructions.

Creating a Gradescope roster: make a file in .csv format with the following fields, in any order (the order on TritonLink/TritonEd is shown); see the next page for tips on making this in EXCEL:

SID, LastName, FirstName, Username, Email
or
SID, Name, Username, Email

- **SID:** Student ID (our PID).
- **Username:** TritonEd username; this is not a standard Gradescope field.
- **Email:** @ucsd.edu email address.
- Gradescope uses the email address to identify student accounts, and uses the name and SID fields to match the handwritten name/Student ID to its roster.
TritonEd uses Username to match uploaded scores to its roster.

Uploading roster to Gradescope:

- Select whether there is a single name column, or separate first and last name columns.
- Gradescope proposes how to match your columns to its standard columns (SID, LastName, FirstName (or just one Name), Email). Adjust this if needed.
- TritonEd needs Username, but this isn't a standard Gradescope field, so Gradescope will initially ignore it. Use ⊕ (circled plus) to add a new field. Pick the Username column in your roster and fill in "Username" in the description.
 - If you don't do this step, Gradescope will discard the "Username" column.
 - If you skipped this step when you initially uploaded the roster, you can upload an updated roster with this column.
- If you're just using Gradescope for exams uploaded by the instructor/TAs, you don't need to notify students about their accounts when uploading the roster; instead, notify them when their first graded exam is "published." But if students will upload assignments, you may want to notify them at this stage.

Downloading grades from Gradescope and uploading to TritonEd: For ID purposes, the score file includes Gradescope's standard columns and any additional columns you uploaded (in this case, "Username"). It also includes the score columns and other data. Upload the Username and appropriate score column(s) to TritonEd.

Accounts for TAs, additional instructors, Concurrent Enrollment, test accounts,...: Manually enter these as single users *after* uploading the roster, since field customizations can only be set by uploading rosters. If you manually enter your TAs first by full name, and then upload a roster with separate last, first columns, it will convert the roster to full name format and won't let you change views from full name to last, first. Gradescope's tech support confirms this behavior, but they were able to switch my class back to separate last & first columns.

Adds: I waited until the first midterm to upload the roster, so there were no further adds. However, if you use Gradescope with homework assignments or quizzes earlier in the quarter while students are still adding, you'll need to go back in and add the late-adds. For Gradescope and all the online homework systems, I prefer to add the new students to the system myself so that the name, username, email, etc. is 100% consistent between all systems (to facilitate syncing with TritonEd, etc.). Some faculty prefer to let students self-enroll, either from the beginning or at least the ones who add late; while this may save you time up-front, you may spend extra time later dealing with inconsistencies that impede exporting grades to TritonEd or a spreadsheet.

Drops: I did not drop students from Gradescope who dropped in the middle of the term. Students only can access assignments they submitted. Assignment statistics, emails about an assignment within Gradescope, etc., only include students who submitted the assignment. However, after uploading an assignment and matching names, it will tell you there are still x students not matched, and if there were any glitches, you may have to figure out whose assignments need to be

re-uploaded. With just two exams in one class and three in another, it was easy enough to check which students had dropped and which ones needed to be re-uploaded. But with weekly assignments or a large number of people dropping, this might become cumbersome. However, if you do drop them, you will lose all their submissions and scores, which could be problematic if you need to refer to them in the future (if they re-add, or if there is an administrative issue). By contrast, in WebAssign (for weekly online homework), the extra names did cause me a bit of extra work, but WebAssign has provision to move people to a "Dropped" list that keeps their scores and work in the system but separates them from the enrolled students.

Using EXCEL to make a Gradescope Roster

TritonLink & TritonEd roster formats have either Username or Email but not both. I made a script to convert to Gradescope's format, but you can do it in EXCEL as follows.

- Use the formulas below, adjusting row/column references D2, D3, etc. as needed.
- Copy it down the column to all other rows.
- If you include TAs, additional instructors, Concurrent Enrollment, or test accounts in the roster, the formulas below might not apply to them. Enter those rows manually, overriding the formulas, or just enter them within Gradescope as single users **after uploading the spreadsheet with the regular students.**

If the Username column is filled in, then generate the Email column with this formula:

	A	B	C	D	E
1	SID	LastName	FirstName	Username	Email
2	A12345678	Smith	Alice	asmith	=CONCATENATE(D2, "@ucsd.edu")
3	A23456789	Smith	Bob	bsmith	=CONCATENATE(D3, "@ucsd.edu")

If the Email column is filled in, then generate the Username column from it with this formula:

	A	B	C	D	E
1	SID	LastName	FirstName	Username	Email
2	A12345678	Smith	Alice	=SUBSTITUTE(E2,"@ucsd.edu","")	asmith@ucsd.edu
3	A23456789	Smith	Bob	=SUBSTITUTE(E3,"@ucsd.edu","")	bsmith@ucsd.edu

Instructions for students, and exams with extra sheets

Included in my exam announcement in advance:

We will be scanning the tests. Please use only black pencils (#2 pencil or darker; HB or B lead for a mechanical pencil). Black or blue ballpoint pens are also OK. Do not use pens that bleed through the paper. Please don't write near the edge of the paper or the stapled corner.

Jelena Bradic found that "H" mechanical pencil leads are common but don't scan well (despite being readable by eye). I found that writing within ~3mm (1/8") of the edges may be missed. Another solution besides warning not to write near the edges would be to provide answer boxes or lines on the exam.

Included in the instructions on the exam:

Write your solutions clearly and legibly in the space provided. If you need more space to finish a problem, ask a proctor for paper (do not use your own paper or blue book). However, scratch paper is not allowed.

Students who need extra paper: Leave enough space to answer the questions, but some students may need more space anyway. I don't allow scratch paper, but if a student requests more paper to finish a problem, I'll provide a "Continuation sheet" with this at the top. I printed continuation sheets on white paper instead of each test color.

Name: _____ **PID:** _____ **Problem #:** _____

- **Write "continued on extra sheet" on the page where you ran out of space.**
- **Fill in the info above and continue your answer below.**
- **Staple this continuation sheet to the end of your exam booklet.**

Scanning a test with extra sheets: Separate exams with extra sheets and scan those exams individually, as they require additional steps to upload to Gradescope. If the test booklet and continuation sheets are different colors (e.g., booklet is on colored paper and continuation sheet is on white paper), then scan with the settings for the main color and check whether the continuation sheets scanned legibly. This has worked for me so far, but if it doesn't work, you may need to separately scan the test booklet and continuation sheets with appropriate settings for each and combine the two files.

Uploading a test with extra sheets: If an exam is more pages than the template, Gradescope will initially split it into 2+ proposed exams, with the last one possibly having a warning due to too few pages. Starting with the last exam fragment, use the option to merge it with the previous one, working backwards till that submission is intact.

Gradescope Rubrics

We should develop training materials on using Gradescope, including scanning, uploading, rubrics, etc. It should be available to all instructors and TAs in Math courses, including undergrad TAs and grad students from other departments, not just the Math Graduate Student TAs. These items about rubrics came up in my classes and in discussions with people using Gradescope in other classes. This is just a starting point and needs to be fleshed out.

- Making rubrics, partial credit, alternative solutions besides the intended method. While an instructor usually makes an answer key or starting rubric, some students will use other methods. The grader may need to add the other methods to the rubric, or ask the instructor if uncertain how to handle it.
- One grader wanted all rubric items to add up to the points on the problem. But it's ok to have multiple solution methods, errors, etc. that overlap in point allocations, as long as they're applied carefully.
- Please use rubric items rather than point adjustments, comments, boxes, pencil tooltips, etc. Avoid point adjustments, comments, boxes, and pencil tooltips, or use them very sparingly if you must. The way these currently work in Gradescope, rubric items better facilitate consistent grading and are easier to review than all other methods of giving points and feedback.
 - Gradescope shows the grader a list of all rubric items, and the statistics screen allows finding all exams on which each rubric item was applied. A more limited list is available for comments, and nothing similar is available for point adjustments, boxes, or pencil tooltips.
 - The other feedback mechanisms are difficult to review afterwards. I wrote a script to scan the "Export Evaluations" files to flag which exams & problems #'s have point adjustments or comments so I could review them, and I wrote to Gradescope to suggest listing them in a similar way to the rubric Statistics screen. But boxes, pencil tooltips, etc. aren't even available in "Export Evaluations". The only way to find them is to check every single exam.
- Grading multiple parts (a),(b),... as separate problems vs. as one combined problem.
 - Try to design problems so that all parts of the problem fit on the same page.
 - If (a), (b), ... are separate problems on the Gradescope template, particularly if they span 2+ pages, it may be harder to deal with errors in one part that propagate into the next part. It's common to avoid double-penalizing when an error in (a) propagates to (b). E.g.,

-0 with negative scoring, or +[full points on (b)] with positive scoring, for
“(b) Correct solution method on erroneous numbers carried from (a).”

if you grade it as one problem, you'll immediately know the error in (a) affects (b).
But if you grade it as separate problems, you may have to look back at (a) when grading (b).
 - If (a),(b),... are combined on the Gradescope template, the min/max score per part will not be automatically enforced. E.g., suppose (a),(b) are each 5 points, and (a) is perfect but you mark off multiple items totaling 7 points off for (b). As separate problems, the score $5-7=-2$ for (b) is capped between $[0,5]$ and becomes 0, yielding a total $(a)+(b)=5+0=5$. But as a combined problem, the total is $10-7=3$, with the additional points deducted on (b) eating away at the points for (a).
 - If they're combined on the template, annotate the rubric items with “(a) ...”, “(b) ...” unless it really applies to the whole problem (like “Correct” or “Blank”).
- Positive vs. negative rubrics: It's currently better to use negative rubrics.
 - In principle, positive rubrics may be friendlier, and it may be easier to give partial credit in some cases, but the equivalent can be done with negative rubrics.

- Gradescope has options to show students the full rubric, hide the rubric, or only show the rubric items that apply. For a problem with a negative rubric, all of these options are respected. For a problem with a positive rubric, it shows students all rubric items even if you select to only show the rubric items that apply. This may lead to confusion or regrade requests on items that don't actually apply to that individual's test. So, I currently prefer negative rubrics with the option selected to show only rubric items that apply.
- For a page with a manually graded series of multiple choice problems, with, e.g., 1 point for each correct part, 0 for each incorrect part, is it better to use a positive rubric (select all correct parts) or negative rubric (select all incorrect parts)? We decided that if the average would likely be above 50%, then a negative rubric would be faster.
- Multiple exam versions:
 - If corresponding problems appear in the same place and one template is sufficient, then upload all versions as one assignment, and design the rubric to fit all exam versions. So in the rubric, characterize the types of issues but avoid using versions-specific numbers/functions/... Alternately, the rubric item could list the values for each version, but this may get tedious and may be better to put in a separate answer key.
 - But if you use Gradescope's automatic grading of multiple choice, etc., and the multiple choice problems are different in each version, you need to upload a separate template for each version, which has complications.
 - If you upload multiple versions as separate assignments, you need to manually keep the rubrics in sync. Edits in the rubric of one version will not automatically propagate to the other versions. There also may be complications in making sure all students are accounted for when uploading, and then merging grades from the separate assignments when done.
 - In April 2019, Gradescope sent me email that they are beta testing new features to help with multiple versions with separate templates. It sounds like it will simplify accounting for all students (verifying that they have an exam in one version only; who doesn't have an exam under any version; and combining grades from all versions into one column when exporting grades). But they did not announce features to keep rubrics synchronized when applicable between corresponding problems on different versions.