

1 Overview

“Create Random Assignments” (CRA) is a program that allows an instructor to generate a set of assignments where each student receives a random selection of questions based on a question bank. The only prerequisite to use the application is a Gmail enabled Google account. Gmail enabled accounts include accounts ending in @gmail.com and accounts provided by your educational institution where Google is your e-mail provider. CRA has the following advantages:

1. Because each students’ assignment is unique, it makes cheating more difficult
2. It allows the instructor to use “popular press” books, television shows, and other ‘unique’ sources where a built-in question bank is not provided.
3. It can generate tests or other physical handouts with many more versions than have traditionally been practical.
4. It operates entirely in the cloud, which allows for a more fluid conversation between instructor and student.
5. It can be used both with short answer type assignments or long answer assignments.
6. It is a Google Apps Script that runs within the instructor’s Google Drive account, so there is no software to purchase for either the student or the instructor.
7. It does not depend on, and is more flexible than, the built-in tools in most LMS. systems¹.

The software is a web application so no installation is required. A link to the free application in the Google Chrome Web Store is available at <https://bensresearch.com/CRA/>; an user can use the software without installing it through the Chrome Store by clicking on the direct link provided on the site. As a Google Apps Script interacting with content in the user’s Google Drive account, the application does require special permissions to be accepted by the user on first use. We discuss these permissions in Appendix A.

Given the software generates a Google Document, the software is incredibly flexible and can be used in a number of creative ways. Instructors worried about cheating on exams can generate different versions for each student in the class. In the context of homework, randomly generated assignments with identical concepts but different questions can change the relationship between study group members. A student cannot as easily copy from their more studious friend as they must understand the *concept* to see how the questions are different.

The software can be used to change team project dynamics as well for instructors concerned with

¹However, there are many tools that can be used to generate multiple choice assignments (some with auto-grading) including some LMS systems. This is not the focus of CRA.

free-riding on group projects. The instructor can split each team into stages, assigning each stage to one member of each team. The instructor can then use CRA to send a random selection of questions to the ‘stage managers.’ This method of splitting the class would force each student to be responsible for submitting one stage of the project, which may reduce free-riding. But because Google Documents are shareable, the students could share the document with their teammates and allow for the benefits of collaboration. Because the questions are different for each group, the teams would have to work independently on each stage of the project.

Finally, because CRA generates a Google Document, the assignments can result in multiple opportunities for the student to learn from an assignment before it is turned-in. Because the instructor remains the owner of the document, they can see the work in progress (and add comments) before it is turned in. It is very common in one of the author’s MBA level courses for students to ask the instructor to look at their assignment and provide feedback multiple times before the due date.

2 Preparing Content for “Create Random Assignments”

Preparing content for the program is relatively easy; the instructor needs two things:

1. A spreadsheet containing a list of questions
2. A spreadsheet containing a list of students

Each spreadsheet is stored in a separate file so that the instructor can keep a single file of students for use throughout the term and can save the question banks from term to term.

2.1 The Question Worksheet

From within a Google Spreadsheet, create the following header columns (the first row):

1. Question
2. Answer
3. Chapter (or Section)
4. Required
5. Questions per Chapter

While *Question* is the only required field, *Answer* and *Chapter* will almost always be used. By supplying an answer to each question, this allows the program to build an answer key that is in the

exact order of the question sheet for each student. The *Chapter* or *Section* allows the instructor to group questions such that the material is equally covered.

Required takes a boolean value (in the form of “yes”/“no”, “y”/“n”, “true”/“false” or “t”/“f”), and allows the instructor to force a question on to the assignment. Finally, *Questions per Chapter* takes an integer value and overrides the default specified when running the program. This feature is probably rarely used and a bit confusing. The CRA software allows the user to specify the number of random questions per chapter/section each student should have placed on their assignment. However, if the user believes that a particular chapter should have more or less questions on the homework than the other chapters, they can specify the appropriate number of questions in the spreadsheet directly. This will override the questions per chapter setting in the interface for that one chapter. However, the user should be careful to specify the same number in this column for all questions in a given chapter. Not doing so will result in inconsistent results.

Let’s take a look at an example (Figure 1):

question	answer	page	required	chapter	questions per chapter
It's been argued that the key to the A's success was inefficiencies (in the labor market		8		SOW1	
Which two economists researched whether baseball's John Hakes and Raymond Sauer		8		SOW1	
Hakes and Sauer investigated whether baseball's lab "grossly inefficient"		8	Y	SOW1	
Workers who are expected to be the most productive paid the most		8		SOW1	
In a world of "rich" and "poor" teams, the best players pay the most		8		SOW1	
Hakes and Sauer found what two states relate to win on-base percentage and slugging		10		SOW1	
How large was the impact of on-base percentage on Twice		10		SOW1	
What role do regressions play in economics?	test tubes	9		SOW1	
Who spent more than \$1.5 billion acquiring playing ta New York Yankees		13		SOW2	5

Figure 1: The figure shows an example question spreadsheet. Note that you can have other columns in the spreadsheet that are unused by the assignment program (“page” in this case).

In this example, we have specified all columns, as well as one column (page) unused by the program. The required column is set to “Y” for one question in Figure 1 and therefore will always appear in the assignment. Further, five questions will always be pulled from chapter SOW2 regardless of the questions per chapter setting in the software interface.

2.2 The Student Worksheet

From within a Google Drive spreadsheet, create the following headers (the first row):

1. Name
2. E-Mail

Both fields are required. Note that the program considers E-Mail to be a unique key. So, even when not sending the assignment over E-Mail (e.g. an exam) specifying a unique value in the E-Mail column is a must.

Name	E-Mail
Liam Ince	liam.ince@example.
Evan Short	evan.short@exampl
Olivia Young	olivia.young@exam
David Lawrence	david.lawrence@ex:
Ella Payne	ella.payne@example
Lucas Hunter	lucas.hunter@exam
Dorothy Ogden	dorothy.ogden@exa
Nicola Ball	nicola.ball@example
Claire Nolan	claire.nolan@exam
Paul Scott	paul.scott@example

Figure 2: List of students in Google Spreadsheets

Under some sets of options, the generated files will have the Google Drive permissions modified such that the student can edit the file directly. In this circumstance, it may be advisable to ask the students for the E-Mail address they have registered with Google.

3 Using the Program

Figure 3: Create Random Assignments application.

Once the program is launched, the instructor has a number of features to choose from (Figure 3):

1. Assignment name
2. Questions per section/chapter
3. Text at the top of the assignment (optional)
4. Spreadsheet with questions
5. Spreadsheet with students
6. Delivery by E-Mail, individual files or a single long file

7. E-Mail subject line
8. Attach a PDF
9. Anyone with a link can access a document
10. Create read only documents
11. Create individual answer keys
12. Limit range (under ‘advanced settings’)

Assignment name serves two purposes; it titles each assignment and it creates a new folder inside of Google Drive where all generated files exist. The two spreadsheet questions allow the instructor to specify the files containing questions and students (discussed in Section 2) and the *Questions per section/chapter* specifies the default number of questions per chapter or section. The user can (optionally) provide further instructions to the students or add a header in the *Text at the top of the assignment* textbox. This content, if specified, will appear above the first question on all generated assignments.

The delivery section determines what type of files you want to generate. If you select *Create and E-Mail individual Google Drive documents* or *Create individual Google Drive documents*, a separate file is created for each student in the class. The student is added as an “editor” and the instructor remains the owner. Under this scenario, the student is able to work directly in Google Drive on their assignment and the instructor is able to grade it by adding comments. The difference between the two individual file delivery options is in the former the student is notified via E-Mail that a new assignment exists. When this setting is enabled, you can specify the subject line of the E-Mail and choose to attach the assignment as a PDF.

When *Create a single long Google Drive document* is selected, a single file is generated containing the questions for every student, with a page break between students. This setting is appropriate when printing the assignment and handing it out in class.

Anyone with a link can access a document is available for situations where the instructor is unsure that the students have Google accounts. Under this setting, the student is not added as an editor, but instead the document’s permissions are set such that anyone with the URL to the document is permitted to edit. The advantage of this setting is that the instructor knows, unambiguously, the student will have access to the document. However, due to the potential interception of the E-Mail containing the link, it may be in violation of your institution’s interpretation of FERPA.

Create read only documents switches the document’s permissions from edit to read only. This allows the instructor to send out an assignment, but forces the student to download it and hand it in separately from Google Drive.

Finally, *Create individual answer keys* generates separate answer key files for each student instead of a single, long file, containing the key for each student with page breaks in-between. This allows the instructor to share the key with the student after the assignment is due.

When you are ready to run the generator, click *Create Assignments*. Status updates will appear at the top of the interface. Once the generator is done, the program will indicate that there are new files inside of your Google Drive account.

3.1 Using the Program with Large Classes

There are two limits in Google Drive to be concerned with: a six minute execution time limit for any app and a 100 messages per day limit imposed on consumer Gmail accounts; this limit does not apply to institutional accounts. If you have a class larger than 35 students, you should read Appendix B.

4 Output

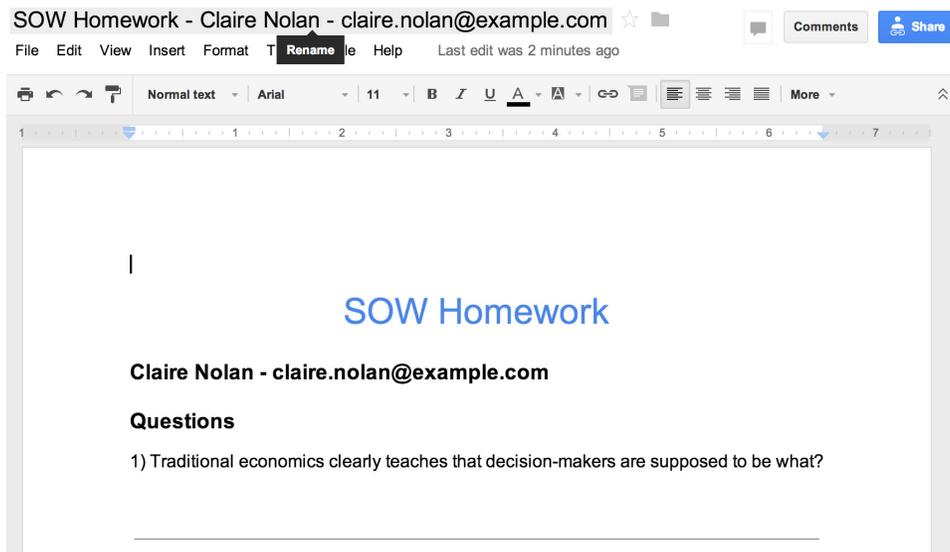


Figure 4: This shows a sample output for an individual student.

As seen in Figure 4, each assignment is titled with the assignment name followed by the student's name and email address. Then each question is numbered allowing space for the student to answer the question.

Appendices

A Create Random Assignments Requested Permissions

CRA is a Google Apps Script that runs using data from the user's Google Drive account. As such, when the user first uses the program, it asks permission to access the following resources (Application Programmer Interface, or API, in parenthesis):

1. Read, send, delete, and manage your email (Gmail App)
2. View and manage the files in your Google Drive (Drive App)
3. View and manage your spreadsheets in Google Drive (Spreadsheet App)
4. View and manage your documents in Google Drive (Document App)
5. Allow this application to run when you are not present (Script App)
6. Send email as you (Mail App)

Before detailing how each of these resources are used, it should be noted that CRA uses these resources with the singular purpose to send randomized homeworks. At no time does the application send data back to the developer or access resources that the user did not specify.

Permission requests with Google Apps Scripts are an 'all or nothing' affair. So, while the first permission allows access to all of Gmail, CRA only uses this interface to send the homework assignments over e-mail. Similarly, CRA only uses the Drive App interface to create a folder and place the the newly created assignments/keys in that folder. Google has separate permissions for managing files in your Drive account (i.e. the Drive App) and interacting with the contents of a given spreadsheet or document (i.e. the Spreadsheet App and Document App interfaces). The Spreadsheet App is used to read both the student and question spreadsheets. Similarly, the Document App is used to create the homework for each of the students.

The last two permissions are perhaps the least obvious. When the user clicks to select either of the two spreadsheets in the CRA application, the Script App interface is used to make a background request such that the user is displayed a list of spreadsheets from their Google Drive account. The Mail App interface is not used to send mail. Instead it is used to determine the user's current sending quota. Consumer Gmail accounts have a limit of 100 e-mails per day. CRA tries to proactively warn the user when the number of e-mails the program will send exceeds the user's current quota. See Appendix B for more details.

B Large Classes, Usage Limits and G Suite

CRA is a Google Apps Script that runs using the initiating user account (your Google account) on Google's infrastructure. The advantage of this approach is that the software is able to send e-mail as you, integrates deeply with Google Drive and is inexpensive for the developer to provide to the world (thus allowing it to be provided with no charge or advertising). The disadvantage to this approach is that the software is subject to the usage limits that Google has imposed on your user account². Two usage limits are of concern when using the software: a daily e-mail quota and a six minute execution limit.

B.1 The Consumer E-Mail Sending Limit

Google imposes a 100 e-mail per day sending limit on consumer accounts and a 1500 a day limit on their G Suite accounts. Consumer Google accounts are free accounts such as those that end in @gmail.com. G Suite accounts are Google accounts created and managed by a company, school, or university. While a 1500 e-mail a day limit is likely not an issue, the consumer account 100 e-mail daily limit could be an issue if you have a class of more than 100 students or you send CRA messages to multiple classes on the same day. There are a few ways to mitigate this issue:

1. Check to see if your school or university has provided you a G Suite account
2. Purchase your own G Suite account (\$60 a year as of Fall 2017)
3. Split your class into smaller groups and send over multiple days

If your institution already uses G Suite accounts this is clearly the easiest mitigation approach. As of Fall 2017, there are only two major players providing e-mail accounts to schools and universities in the United States: Microsoft and Google. Further, while faculty accounts are often on Microsoft Exchange, universities often complement these accounts with G Suite accounts for students as they are cheaper. This usually means that G Suite accounts also exist for faculty, but they are not set up as the primary e-mail provider. Even if you do not believe you have G Suite accounts at your institution, it is worth asking your IT department.

Assuming you can afford the \$60 a year fee, a G Suite account of your own is the next best option. A G Suite account³ is a Google account tied to a domain name you own. For instance, you might have a website at <http://YourName.com>. With G Suite, you can create an e-mail account such as YourFirstName@YourName.com that you can use like any other Gmail account. If you do not already have a domain name, you can purchase one as part of the G Suite sign up process.

²These usage limits are summarized here: <https://developers.google.com/apps-script/guides/services/quotas>.

³Can be purchased from <https://gsuite.google.com>.

While the marketing at <https://gsuite.google.com> is focused on small businesses, you can sign up for a G Suite account with a single user (the lowest cost, ‘basic’ account is sufficient). Signing up for a G Suite account can be a bit complicated, but Google provides telephone and chat support for this process on the aforementioned website.

Initially when you sign up for a G Suite account, you will be in a 14 day free trial period. Additionally, you will not have made any payments to Google. This is problematic as the consumer e-mail sending limit will be in place until you have (a) paid at least \$30 and (b) are no longer in the free trial. This can be rectified with a few steps.

In your new Gmail account, select the gear in the upper right corner and select ‘manage this domain’. From this console, select ‘Billing’ then select ‘Access billing account’ from the ‘Actions’ menu. There will be a button that says ‘Pay early’ allowing you to make a payment greater than \$30. Unfortunately, Google does not provide a button to exit the free trial, but we can force the issue by creating ten user accounts. From the three lined menu button in the upper left corner, select ‘Users.’ On the manage users page, select the plus button in the bottom right corner. Here you can enter fake user account information (you will be deleting this user in a moment). Repeat this process an additional nine times. At this point a red dot will be in the upper right corner. Clicking on that dot should provide a link to leave the free trial. If it does not, go to a different page and come back to the users page. Once you have left the free trial, you can delete all of the fake accounts. After 24-48 hours all consumer limits will be removed from your account.

If a G Suite account is not a practical solution, you can split the class into batches and send the CRA homeworks over multiple days. In the CRA interface, there is a button labeled ‘show advanced settings.’ Here you can select to send the homework to a subset of students. For instance, entering 1 and 30 in the two boxes would send the homework to the first thirty students in the selected gradebook. Once Google’s e-mail sending limit has reset, you could send the next thirty students their assignment by entering 31 and 60.

B.2 The Six Minute Execution Limit

The six minute execution limit means that no Apps Script can run for six consecutive minutes. (This does not include the time it takes the user to enter information into the interface, only the time where the script is processing). The creation of Google Drive documents is computationally slow. Therefore, when using either the ‘Create and E-Mail individual Google Drive documents’ or ‘Create individual Google Drive documents’ delivery options, you might be susceptible to this limit (this is particularly true if you have selected the ‘Create individual answer key files’ option). While it depends on the length of the question bank, in general this limit impacts classes with more than 50 students.

There is a solution to this problem: you can send to a subset of the class using the limits under the advanced section of the CRA interface. For instance, you might enter 1 and 30 into the limit range section of the interface thereby sending the homework to only the first thirty students in the class. However, unlike the e-mail limit, the execution limit is per run. That means you could immediately send the homework to students 31 through 60 after the first run is complete.