

LARSON—MATH 255—CLASSROOM WORKSHEET 15
Random Numbers—Random Integers.

1. (a) Start the Chrome browser.
(b) Go to `http://cocalc.com`
(c) Login using **your VCU email address** .
(d) Click on our class Project.
(e) Click “New”, then “Worksheets”, then call it **c15**.
(f) For each problem number, label it in the Sage cell where the work is. So for Problem 2, the first line of the cell should be `#Problem 2`.

Random Values

2. `random()` returns a random number in $[0, 1]$. Execute it a few times to see what you get.
3. Use `random()` to define a function `coin_flip()` which randomly returns the string “H” (for heads) half the time and returns the string “T” (for tails) half the time. Try it a few times; your results will vary.
4. Run your coin flipping program 100 times and collect data. A random coin flipping program should come up heads about half the time. How many times do you get heads?
5. Now run your coin flipping program 1000 times and collect data. A random coin flipping program should come up heads about half the time. How many times do you get heads?
6. There’s a *pattern* here that can be usefully encapsulated as its own function. Define a function `heads_percentage(n)` that inputs a positive integer n and outputs the percentage of heads after n coin flip experiments.
7. Use `scatter_plot` to sketch a graph of the results of `heads_percentage(n)` for values of n from 1 to 10000.

8. It is often useful to generate random integers. It only makes sense to generate random integers from within some range of integers. We do this with `randint()`.

Evaluate `randint(5,100)` a few times; your results will vary. This will generate random integers in the range $[5, 100]$, including both endpoints.

9. **Investigate.** Does `randint()` produce a *uniform distribution*? (That is, as you repeat experiments of `randint(a,b)` are the number of produced outcomes of each possible integer roughly the same? Do some experiments!).

Put your results in a list `results` and then try `histogram(results)`. Also try a `scatter_plot`.

10. **A second investigation.** `randint(1,10)` should produce a 1 about $\frac{1}{10}$ of the time. The larger the number of experiments the closer your number of 1's should be to $\frac{1}{10}$ of all outcomes. Try larger and larger numbers of experiments.

More: make a `scatter_plot` with your results.

11. **Extra: Learn more Python!** If you have extra classtime, use it to learn more Python. Go to Codecademy ([codecademy.com](https://www.codecademy.com)), sign up for a free account, and do the *Learn Python 2* tutorial <https://www.codecademy.com/learn/learn-python>. (This one is totally free—and useful.)

Getting your classwork recorded

When you are done, before you leave class...

- Click the “Make pdf” (Adobe symbol) icon and make a pdf of this worksheet. (If Cocalc hangs, click the printer icon, then “Open”, then print or make a pdf using your browser).
- Send me an email with an informative header like “Math 255—c15 worksheet attached” (so that it will be properly recorded).
- Remember to attach today’s classroom worksheet!