Instructions:

- Your submission will consist of three files (and nothing else):

  - `fillintheblank.m`
  - `sumsquaredifference.m`
  - `piestimate.m`

- Very Important: Create a single compressed (.zip) folder with these files. Name it LastNameFirstNameHW1, e.g. HeinzMichaelHW1.zip

———————————

0 (Review). Go through sections 3, 4, 8 and 9 of the "Braun MATLAB Tutorial" (on the webpage under Additional Info in the Schedule Table) and make sure you understand what each line is doing by typing them the MATLAB command window.

Make sure to make liberal use of MATLAB help and google. Sections 3-4 should be review and Sections 8-9 should be somewhat new. Make a list of the ones you don't fully understand and come ask me in office hours.

1. Download `fillintheblank.m` from the course webpage and follow the prompts within.

2 (Sum Square Difference). The sum of the squares of the first ten natural numbers is

$$1^2 + 2^2 + \cdots + 10^2 = 385$$

The square of the sum of the first ten natural numbers is

$$(1 + 2 + \cdots + 10)^2 = 55^2 = 3025$$

Hence the difference between the sum of the squares of the first ten natural numbers and the square of the sum is $3025 - 385 = 2640$. Find the difference between the sum of squares of the first one hundred natural numbers and the square of the sum.

Write a script `sumsquaredifference.m` that does this and save the requested answer as a variable named `mydiff`.

Hint: Ideally your script is three lines long. First define `sumsquare`, then `squaresum`, and then compute `mydiff` as their difference.
Source: Project Euler, Problem 6

3 (Estimating π). Consider a 2×2 square centered at the origin with a unit disk "bullseye". A dart is thrown at the target and lands randomly inside the square. We say the dart is a hit if it lands inside the circular bullseye. This just means that the landing coordinates (x, y) of a hit satisfy $x^2 + y^2 \leq 1$.
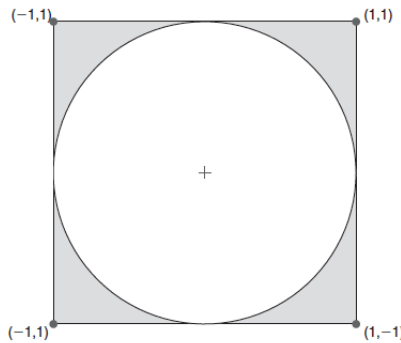
If we throw n darts and n is very large, then the fraction of darts that hit the bullseye should approximate the ratio of the bullseye area to the square area, i.e.,

$$\frac{\text{hits}}{n} \approx \frac{\pi r^2}{(2r)^2}$$

where here $r = 1$. From this we can estimate π:

$$\pi \approx 4\frac{\text{hits}}{n}$$

Write a script `piestimate.m` that simulates the throwing of 10,000 darts and displays the resulting π-estimate. Save that value as a variable named `mypi`. Try your best to do this without a `for` loop (don't worry if you don't know what that is). Instead try to directly operate on the matrices themselves instead of looping through each entry.

Hint: `rand` generates a random number uniformly distributed in $[0, 1]$ (but you need to transform that so it lies in $[-1, 1]$). `rand(m, n)` creates a $m \times n$ matrix with entries that are uniformly distributed in $[0, 1]$. Note that each time you call `rand`, the result is different.

Possibly Helpful Hint: Given a matrix `A`, what does `sum(A, 1)` and `sum(A, 2)` do?

Source: Insight Through Computing by Fan and Van Loan