Final Assignment for MT471S

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Please submit these programs by 16:00 on 2022-12-16 by:

- uploading the `.c` files to the MT471S Moodle.

You **only** need to submit the `.c` file for each assignment. Your assignments are:

1. Write a program to calculate:
$$\int_0^r \frac{\sin(\alpha x)}{x}\, dx$$

   using the Simpson's rule. The program should read r and α from the user and then choose the number of steps by making sure that the step size, h, satisfies $h \leq 0.001/\alpha$.

   Hint 1: You can get $\sin(x)$ using the function `sin(x)` from `math.h`.

   Hint 2: Be careful at $x = 0$!

2. In question 1 on assignment 3, we wrote a program that read a list of numbers and checked if each had a numbers had an inverse with respect to addition. In this question, you have to adapt *your* program to work with files.

   Write a program that reads the file `numbers.txt` which contains a list of numbers. It should make two new files: `inverses.txt` and `noinverses.txt`. The file called `inverses.txt` should contain all the numbers from the list that have an inverse. The file `noinverses.txt` should contain all the other numbers. The program should also display how many numbers are in each file.

   For example, if `numbers.txt` contains `-2.0 0.0 3.2 2.0`, then `inverses.txt` should contain `-2.0 0.0 2.0` and the `noinverses.txt` should contain `3.2`. The program would print a message to the screen saying:

   `The numbers.txt file had 3 numbers with inverses and 1 number without.`

   Hint 1: Your program should use `fopen`, `fscanf`, `fprintf` and `fclose`.

   Hint 2: As with the first program, you will probably want to use an array. You can assume that `numbers.txt` contains at most 100 numbers.