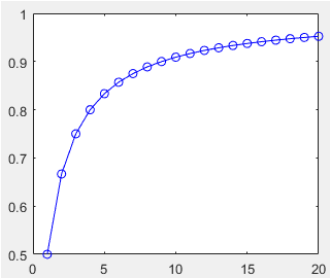
MATLAB Programming NCTU Fall 2022 Practice Problems for Exam#1

These are example exam problems. You can practice with these to know what kind or problems to expect in the exam. Save each program to a separate m-file. (There will be 5 problems in Exam#1.)

1. Write a function that takes only one inputs `m`, which is a positive scalar integer. The function You need to compute f_n (given below) for all $1 \le n \le$ `m` and plot the result. An example output with `m`=20 is shown here. (Deduction if loops are used.) Use $f_n = \sum_{k=1}^{n} \frac{1}{k(k+1)}$.

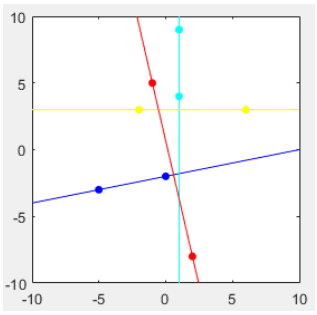


2. Write a function that takes an input `n`, a positive odd integer, and output a `n`x`n` matrix with the type of pattern shown to the right (example for `n`=7); the border elements are always zero and the maximum is at the center. (Deduction if loops are used.)

```
0 0 0 0 0 0 0
0 1 1 1 1 1 0
0 1 2 2 2 1 0
0 1 2 3 2 1 0
0 1 2 2 2 1 0
0 1 1 1 1 1 0
0 0 0 0 0 0 0
```

3. Write a function that takes one input matrix `W`. Each row of `W` is a 4-element vector `[x1 y1 x2 y2]` that represents a pair 2-D points. For each point pair, plot a line that goes through the point pair, as well as the points themselves. (Set the range to `-10~10` for both x and y axes; all the coordinates given will be in this range.) Furthermore, draw each line and its pair of points in a different color. Decide for yourself how you choose the colors; a simple approach is to use a color map function. You can use a layer of loop.

Example plot for input `[-5 -3 0 -2; 1 4 1 9; -2 3 6 3; -1 5 2 -8]`



4. Write a function that takes two inputs: The first is an image `im`, and the second is a 4-element vector `[x1 y1 x2 y2]` representing a rectangle. Your function returns `im` with the specified rectangular region replaced by its complement. Note: `im` may be a gray-scale or RGB image, and is of type double. Do nothing if `x2<x1` or `y2<y1`, or if the rectangular region is completely outside of the image. Your function should be able to handle cases when any of these coordinates are outside of the image.

An example is given here: (image size: 360x240; the second input is `[100 40 180 260]`; left: input; right: output)