MATH 3310 SPRING 2022 HOMEWORK 1
Due Friday February 4th midnight by email

Instructions

You can hand write or type up your answers to the non coding questions. For the coding questions include both the code and the output.

Questions

#1. $y_0 = 100$ and $\Delta y_n = -.4y_n$.
a) Find y_5
b) Find the recursion formula for y_{n+1}

#2 Pick one of the following scenarios (or make up your own if you prefer). Identify a suitable problem statement. From this problem statement, identify what variables and factors could impact the problem. Which of these variables do you deem to be the important ones.

- The population growth of a single species
- The number of infected for a disease outbreak
- Designing a classroom to accommodate students
- Figuring out how much of a product or make, and or how to distribute and or how much to charge
- Can you actually fix a dice roll where it has to bounce
- How much free time do I have each week

#3 Pick one of the following scenarios (or make up your own if you prefer). Identify a suitable problem statement. From this problem statement, identify what variables and factors could impact the problem. Which variables do you deem to be the important ones. Are there any variables that could be simplified into constants (Find at least 1)? What might a possible submodel be?

- An ecologist is interested in studying how hares and owls interact. Owls eat hares, and are especially interested in young and inexperienced hares which are easier to catch. Owls often like to hunt in areas lacking cover, or at food sources that the prey congregate.

- People love fast things. Which computer systems offer the most speed?

- It is never too early to think about retirement savings. How should one go about saving for retirement?

- A statistician is interested in going to Vegas and making it big. What games should be played and what could be done to increase the odds of winning?

- Can you actually fix a dice roll where it has to bounce

- How worried should we be about a disease?

#4 Lets look at the population of middle class workers at a power plant. The plant start with 4000 workers. One month later in January 100 people don't come back from their holidays. In June 400 students join the plant. In August, 200 students stop working at the plant and go back to class. In December people get a bonus and 200 workers retire. Model this using any program you want, assuming that this exact trend happens for 5 years. Plot the population of workers, and how many workers are there after 5 years have elapsed? List some of the assumptions you have made.

#5 Lets look at a slightly more advanced SIR model.
$S_{t+1} = S_t - bS_tI_t$
$I_{t+1} = I_t + bS_tI_t - aI_t$
$R_{t+1} = R_t + aI_t$
Assume at time zero there are 5090 in the S class, 10 in the I class, and 0 in the R class. Pick any realistic positive values for b and a and plot the graph of these populations out to time 100. Explain why the values are or are not realistic. Do you seem to be going to an equilibrium point yet, and if so what equilibrium are you going towards? If not, do you think you will end up going to an equilibrium point?