Overview of Manufacturing Systems

Problem 1

Problem Statement

There will be multiple choice/checkbox type of questions on Week 1: Overview of Manufacturing Systems.

Probability

Problem 2

Problem Statement

I throw a pair of dice and I tell you that they sum to 8 but I don't tell you what each die shows. What is the conditional probability that neither one shows 4?

Problem 3

Problem Statement

The probability that it will be sunny tomorrow is .8. The probability that it will rain tomorrow is .19. The probability that it will snow tomorrow is .01.

If it is sunny on a given day, the probability that I will have a cold the next day is .02. If it rains that day, the probability that I will have a cold a day later is .1. If it snows one day, I will have a cold the day after that with probability .2.

What is the probability I will have a cold in two days?

Problem 4

Problem Statement

I flip a biased coin 12 times. The bias is such that the probability of heads on one flip is .45.

a) What is the probability that there are 6 or fewer heads?
b) What is the expected number of heads?
c) What is the standard deviation of the number of heads?

Stochastic Process

Problem 5

Problem Statement

Figure 1 shows the transition graph of a three-state discrete time Markov process.

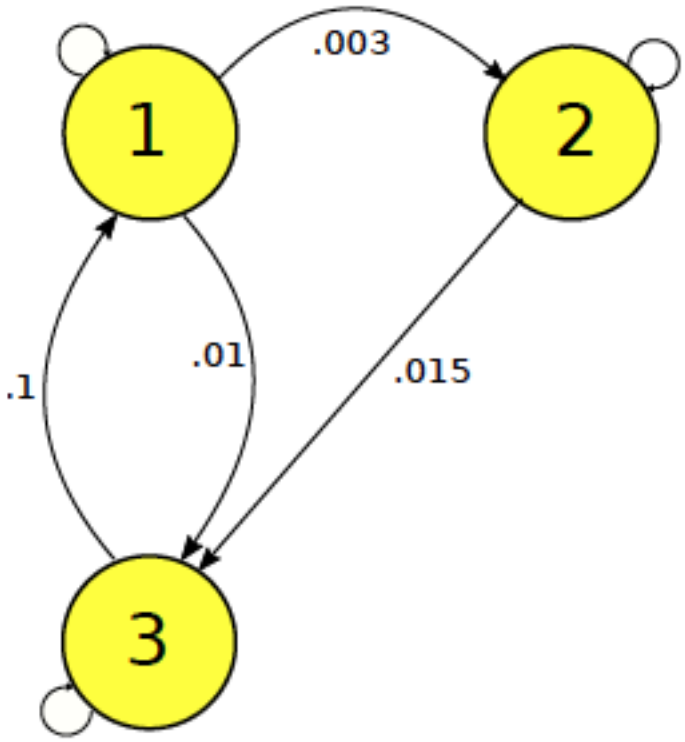

Figure 1: Discrete time Markov process transition graph

a) Write the values of all the non-zero transition probabilities $P_{ij} = \mathrm{P}(\mathrm{X}(\mathrm{t}+1) = \mathrm{i} | \mathrm{X}(\mathrm{t}) = \mathrm{j})$ for i, j = 1, 2, 3:
b) Suppose the system is in state 1 at time t=0. What are the probabilities that the system will be in states 1, 2, 3 at time t=1?
c) Let π_i be the steady-state probabilities of state i. Write the steady-state transition equations. (We will not ask for this on the exam, but you will need to know how to do this to solve part d)
d) Find the steady-state probabilities

Queuing Theory

Problem 6

The sandwich maker of the EE-Cole-Eye Sandwich Truck was just fired (for a reason described below) and EE-Cole-Eye needs to find a

replacement. They want to make sure that the replacement is fast enough so that customers don't have to wait too long on line. Customers arrive according to a Poisson process with arrival rate λ and sandwich makers take an exponentially distributed length of time to make a sandwich, with mean time $\frac{1}{\mu}$. There are no limits to the number of customers that wait for sandwiches. Consider the queue of customers and analyze it assuming it is in steady state.

Problem Statement

a) Write a formula for F(N), the probability that there are N customers of fewer in the line.
b) Suppose customers arrive once every 30 seconds on the average and the sandwich maker can make a sandwich in 29 seconds on average. What is the average number of customers in the line?
c) What is the probability that there are 5 or fewer customers in the line?
d) The performance described in the previous part is unsatisfactory, and that is why the sandwich maker was fired. How fast must the new sandwich maker work (that is, what is the required μ) so that the probability that there are 5 customers or fewer in the line is greater than 0.9?
e) What will be the average number of customers in the queue with this new sandwich maker?

Inventory

Problem 7

The Snowy Peaks ski resort closes for the season at the end of February. In addition to supplying ski equipment, food, and many other things to its customers, it has to heat their hotel rooms. Since the number of

customers in February is unknown, the amount of heating oil needed is unknown. They have to decide how much oil they should order. The Snowy Peaks marketing department feels that the amount of oil needed will be determined by a triangular distribution with a = 1000 gallons, c = 2000 gallons, and b = 4000 gallons.

Problem Statement

The resort's oil supplier will charge them $3.00 per gallon in February. They estimate that each gallon that is consumed creates $6.00 in revenue. Since February is the last month of the ski season, any oil that is left at the end of the month must be discarded in an environmentally responsible manner. Consequently, any oil that remains on March 1 costs $2.00 to remove. In other words, it has a negative salvage value: -$2.00 per gallon.

They would like to maximize their net profit. How much oil should they order for February?

Toyota Production System

Problem 8

There will be multiple choice/checkbox questions on the Week 6: Toyota Production System.

Single Part Type I

Problem 9

There will be questions similar to the Practice problems and Graded Problems of Week 7: Single Part Type I.