

2025-2026

ECON 205

Problem Set 3

- 1) A large stockpile of used pumps contains 20% that are in need of repair. A maintenance worker is sent to the stockpile with three repair kits. She selects pumps at random and tests them one at a time. If the pump works, she sets it aside for future use. However, if the pump does not work, she uses one of her repair kits on it. Suppose that it takes 10 minutes to test a pump that is in working condition and 30 minutes to test and repair a pump that does not work. Find the mean and variance of the total time it takes the maintenance worker to use her three repair kits.

- 2) In southern California, a growing number of individuals pursuing teaching credentials are choosing paid internships over traditional student teaching programs. A group of eight candidates for three local teaching positions consisted of five who had enrolled in paid internships and three who enrolled in traditional student teaching programs. All eight candidates appear to be equally qualified, so three are randomly selected to fill the open positions. Let Y be the number of internship trained candidates who are hired.
 - (i) Does Y have a binomial or hypergeometric distribution? Why?
 - (ii) Find the probability that two or more internship trained candidates are hired.

- 3) A parking lot has two entrances. Cars arrive at entrance I according to a Poisson distribution at an average of three per hour and at entrance II according to a Poisson distribution at an average of four per hour. What is the probability that a total of three cars will arrive at the parking lot in a given hour? (Assume that the numbers of cars arriving at the two entrances are independent.)

4) A geological study indicates that an exploratory oil well should strike oil with probability 0.2.

- i) What is the probability that the first strike comes on the third well drilled?
- ii) What is the probability that the third strike comes on the seventh well drilled?
- iii) Find the probability that the third oil strike comes on the fifth well drilled.
- iv) What assumptions did you make to obtain the answers to parts (i) and (ii)?
- v) Find the mean and variance of the number of wells that must be drilled if the company wants to set up three producing wells.

5) A city government wants to compare two transportation policies:

- the current fuel tax (Policy A)
- a new congestion-pricing policy (Policy B) that charges drivers for entering busy areas.

To see which policy people find more attractive, the city randomly selects four citizens.

Each person is shown three policy summaries in random order - two about Policy A and one about Policy B.

Each person then chooses the one they prefer. Assume that people see no real difference and they pick randomly among the three summaries independently from each other.

- a) Write the probability function of Y .
- b) Find the probability that at least three out of four people choose the new policy.
- c) Find the expected value of Y .
- d) Find the variance of Y .

6) If $M_X(t) = e^{5(e^t - 1)}$, then find $E(X)$ and $V(X)$.

7) The manager of an industrial plant is planning to buy a new machine of either Type A or Type B. If t denotes the number of hours of daily operation, the number of daily repairs Y_1 required to maintain a machine of type A is a random variable with mean and variance both equal to $.10t$. The number of daily repairs Y_2 for a machine of type B is a random variable with mean and variance both equal to $.12t$. The daily cost of operating A is $C_A(t) = 10t + 30Y_1^2$; for B it is $C_B(t) = 8t + 30Y_2^2$. Assume that the repairs take negligible time and that each night the machines are tuned so that they operate essentially like new machines at the start of the next day. Which machine minimizes the expected daily cost if a workday consists of (a) 10 hours and (b) 20 hours?