

ENGR 123 (2020) Assignment 5 Due 12 midnight Thursday, 24 September

Topics: DISCRETE RANDOM VARIABLES

1. [6 marks] After manufacture, computer disks are tested for errors. Let X be the number of errors detected on a random chosen disk. The following table presents values of the cumulative distribution function $F(x)$ of X .

x	$F(x)$
0	0.41
1	0.72
2	0.83
3	0.95
4	1.00

- (a) What is the probability that two or fewer errors are detected?
- (b) What is the probability that more than three errors are detected?
- (c) What is the probability that exactly one error is detected?
- (d) What is the probability that no errors are detected?
- (e) What is the most probable number of errors to be detected?
2. [3 marks] In a study of lifetime for a certain type of laptop battery, engineers found that the probability that the battery will last for 5 hours or more is 0.3. Suppose four such batteries are in use in independent laptops.
- (a) Find the probability that exactly one of the batteries will last 5 hours or more.
- (b) Find the expected number of batteries that will last 5 hours or more.
3. [6 marks] For each of the scenarios below, select:

A : variable is binomial (approximately)

B : variable is Poisson (approximately)

C : variable is neither

If you select C , explain why you rejected both binomial and Poisson models?

- (a) The number of errored bits in a packet of 1024 bits.
- (b) Time between packets arriving at a router.
- (c) Student has reaction time to 100 stimuli tested. Count as "success" = reacting within 0.1 second. Count the number of successes.
4. [4 marks] Records show that arrival requests to a certain server occur at the rate of 3 per minute. In one minute, what is the probability of having
- (a) 2 requests?
- (b) Less than 2 requests?
- (c) At least 4 requests?
5. [6 marks] At a whiteware production facility, fridges which have been damaged are scrapped (costing \$250) as it is too expensive to interfere with the production line and repair any damage. If damaged fridges occur so that the number has a Poisson distribution with the rate $\lambda = 2.5$ each day, then what is the mean and standard deviation of the cost of scrapping the fridges in a 30 day month?

ENGR 123 - Tutorial 5 questions for 21–25 September 2020

1. A box contains 3 red marbles and 5 blue marbles. Two marbles are taken at random *without* replacement, and the random variable X is the number of blue marbles obtained.
 - (a) Write down the sample space, i.e., the set of all possible outcomes.
 - (b) Write down the set of possible *values* of the random variable X and draw up a table showing the *probability distribution* of X , i.e., $P(X = x_i)$ for each value x_i .
 - (c) Find $E(X)$, $E(X^2)$, $\text{Var}(X)$.

2. For each of the scenarios below, select:

A : variable is binomial (approximately)

B : variable is Poisson (approximately)

C : variable is neither

In any case, explain your choice!

- (a) Interview 100 people, 50 couples and ask "Should we introduce paid paternity leave?" X counts the number of people saying "YES".
 - (b) The number of errors in a 20ms transmission.
3. A set of 10 microprocessing chips from a large population are randomly selected and are independently tested to determine if they are acceptable for a certain application. Eighty percent of chips in the population are acceptable.
 - (a) What is the probability that there are exactly 8 chips acceptable?
 - (b) What is the probability of having more than 8 chips acceptable?
 - (c) What is the probability of having less than 8 chips acceptable?
 4. A quality engineer is in charge of testing whether or not 90% of the DVD players produced by his company conform to specifications. To do this, the engineer randomly selected a batch of 12 DVD players from each day's production. The day's production is acceptable provided no more than 1 DVD player failed to meet specifications. Otherwise, the entire day's production has to be tested.
 - (a) What is the probability that the engineer incorrectly passes a day's production as acceptable if only 80% of the day's DVD player actually conform to specification?
 - (b) What is the probability that the engineer unnecessarily requires the entire's day production to be tested if in fact 90% of the DVD players conform to specifications?
 5. Records show that on average, three emergency calls per day are received by a service engineer. What is the probability that on a particular day: (a) three; (b) two; (c) four calls will be received?