ECEN321 Engineering Statistics

Homework 1 (total 110 marks) – no need to submit for marking

Question 1 [10 marks; 2.5 marks each for part a,b,c,d]

There are 15 numbers on a list, and the smallest number is changed from 12.9 to 1.29.

a. Is it possible to determine by how much the mean changes? If so, by how much does it change?

b. Is it possible to determine the value of the mean after the change? If so, what is the value?

c. Is it possible to determine by how much the median changes? If so, by how much does it change?

d. Is it possible to determine by how much the standard deviation changes? If so, by how much does it change?

Question 2 [10 marks; 2.5 marks each for part a,b,c,d]

A die (six faces) has the number 1 painted on three of its faces, the number 2 painted on two of its faces, and the number 3 painted on one face. Assume that each face is equally likely to come up.

a. Find a sample space for this experiment.

b. Find P(odd number).

c. If the die were loaded so that the face with the 3 on it were twice as likely to come up as each of the other five faces, would this change the sample space? Explain.

d. If the die were loaded so that the face with the 3 on it were twice as likely to come up as each of the other five faces, would this change the value of P(odd number)? Explain.

Question 3 [15 marks; 5 marks each for part a,b,c]

Six hundred paving stones were examined for cracks, and 15 were found to be cracked. The same 600 stones were then examined for discoloration, and 27 were found to be discolored. A total of 562 stones were neither cracked nor discolored. One of the 600 stones is selected at random.

a. Find the probability that it is cracked, discolored, or both.

b. Find the probability that it is both cracked and discolored.

c. Find the probability that it is cracked but not discolored.

Question 4 [5 marks]

A company has hired 15 new employees, and must assign 6 to the day shift, 5 to the graveyard shift, and 4 to the night shift. In how many ways can the assignment be made?

Question 5 [30 marks, 5 marks each for part a,b,c,d,e,f]

Of all failures of a certain type of computer hard drive, it is determined that in 20% of them only the sector containing the file allocation table is damaged, in 70% of them only nonessential sectors are damaged, and in 10% of the cases both the allocation sector and one or more nonessential sectors are damaged. A failed drive is selected at random and examined.

a. What is the probability that the allocation sector is damaged?

b. What is the probability that a nonessential sector is damaged?

c. If the drive is found to have a damaged allocation sector, what is the probability that some nonessential sectors are damaged as well?

d. If the drive is found to have a damaged nonessential sector, what is the probability that the allocation sector is damaged as well?

e. If the drive is found to have a damaged allocation sector, what is the probability that no nonessential sectors are damaged?

f. If the drive is found to have a damaged nonessential sector, what is the probability that the allocation sector is not damaged?

Question 6 [15 marks; 5 marks each for part a,b,c]

An automobile insurance company divides customers into three categories, good risks, medium risks, and poor risks. Assume that 70% of the customers are good risks, 20% are medium risks, and 10% are poor risks. Assume that during the course of a year, a good risk customer has probability 0.005 of filing an accident claim, a medium risk customer has probability 0.01, and a poor risk customer has probability 0.025. A customer is chosen at random.

a. What is the probability that the customer is a good risk and has filed a claim?

b. What is the probability that the customer has filed a claim?

c. Given that the customer has filed a claim, what is the probability that the customer is a good risk?

Question 7 [25 marks; 5 marks each for part a,b,c,d,e]

A quality-control program at a plastic bottle production line involves inspecting finished bottles for flaws such as microscopic holes. The proportion of bottles that actually have such a flaw is only 0.0002. If a bottle has a flaw, the probability is 0.995 that it will fail the inspection. If a bottle does not have a flaw, the probability is 0.99 that it will pass the inspection.

a. If a bottle fails inspection, what is the probability that it has a flaw?

b. Which of the following is the more correct interpretation of the answer to part (a)?

   i. Most bottles that fail inspection do not have a flaw.

   ii. Most bottles that pass inspection do have a flaw.

c. If a bottle passes inspection, what is the probability that it does not have a flaw?

d. Which of the following is the more correct interpretation of the answer to part (c)?

   i. Most bottles that fail inspection do have a flaw.

   ii. Most bottles that pass inspection do not have a flaw.

e. Explain why a small probability in part (a) is not a problem, so long as the probability in part (c) is large.