Question 1

a. Consider waiting times (in minutes): 4.21, 5.55, 3.02, 5.13, 4.77, 2.34, 3.54, 3.20, 4.50, 6.10, 0.38, 5.12, 6.46, 6.19, 3.79.

Determine the five-number summary: Minimum, Q1, Median, Q3, Maximum. Based on the results obtained, give an interpretation about the data. [**3 Marks**]

b. The SpaceX space program lasted from 2020 until 2024 and included 13 launches. The missions lasted from as little as 7 hours to as long as 301 hours. The duration of each launch is listed below: 9, 195, 241, 301, 216, 260, 7, 244, 192, 147, 10, 295, 142.

Find the mean and standard deviation of the launch times. [**2 Marks**]

Question 2

A study on ethics in the workplace by the Ethics Resource Center and Kronos, Inc. revealed that 35% of employees admit to keeping quiet when they see co-worker misconduct. Suppose 75% of employees who admit to keeping quiet when they see co-worker misconduct call in sick when they are well. In addition, suppose that 40% of the employees who call in sick when they are well admit to keeping quiet when they see co-worker misconduct. If an employee is randomly selected, determine the following probabilities: [**5 Marks**]

a. The employee calls in sick when well and admits to keeping quiet when seeing co-worker misconduct.

b. The employee admits to keeping quiet when seeing co-worker misconduct or calls in sick when well.

c. Given that the employee calls in sick when well, he or she does not keep quiet when seeing co-worker misconduct.

d. The employee neither keeps quiet when seeing co-worker misconduct nor calls in sick when well.

e. The employee admits to keeping quiet when seeing co-worker misconduct and does not call in sick when well.

Question 5

If the weather is Snowy, then the player will play or not? [**5 Marks**]

Weather	Player play	Weather	Player play
Sunny	Yes	Cloudy	Yes
Rainy	No	Sunny	No
Cloudy	Yes	Snowy	Yes
Sunny	No	Cloudy	No
Sunny	Yes	Rainy	Yes
Snowy	No	Snowy	Yes
Rainy	No	Snowy	No

Question 6

a. Incidence of a rare disease. Only 1 in 1000 adults is afflicted with a rare disease for which a diagnostic test has been developed. The test is such that when an individual actually has the disease, a positive result will occur 99% of the time, whereas an individual without the disease will show a positive test result only 2% of the time. If a randomly selected individual is tested and the result is positive, what is the probability that the individual has the disease? [**3 Marks**]

b. A certain machine makes electrical resistors having mean resistance of 40 ohms and standard deviation of 2 ohms. If the resistance follows a normal distribution and can be measured to any degree of accuracy: [**2 Marks**]

    i. What percentage of resistors have resistances that exceed 43 ohms?

    ii. What percentage of resistors will have resistances that exceed 43 ohms to the nearest ohm?

Question 3

a. Based on past experience, it is assumed that the number of flaws per foot in rolls of grade 2 paper follows a Poisson distribution with a mean of 0.2 flaw per foot. What is the probability that in a [**3 Marks**]

i. 1-foot roll, there will be at least 2 flaws?

  ii. 50-foot roll, there will be greater than or equal to 5 flaws and less than or equal to 8 flaws?

b. An individual has 3 different email accounts. Most of her messages, in fact 70%, come into account #1, whereas 20% come into account #2 and the remaining 10% into account #3. Only messages in account #2 and #3 are spam. Of the messages in account #2, only 1% are spam, whereas 50% of the messages in account #3 are spam. If a randomly selected message is spam, what is the probability that it randomly selected message came from account #3? [**2 Marks**]

Question 4

a. The discrete random variables X and Y have joint probability mass function [**3 Marks**]

$$f(x, y) = \begin{cases} cxy & x = 1, 2, 3, \ y = 1, 2 \\ 0 & \text{otherwise} \end{cases}$$

  i. Find the value of constant c.

  ii. Find the marginal probability function for X and Y.

From a lot of 10 items containing 3 defective items, a sample of 4 items is selected randomly. Let the random variable X denote the number of defective items in the sample. Answer the following when the sample is drawn without replacement: [**2 Marks**]

  i. Find the probability distribution of X.

  ii. Find $P(X \leq 1)$

  iii. Find $P(0 < X \leq 2)$