SAMPLE 1

Question 1. (2 marks) In a large corporation, 80% of the employees are men and 20% are women. The highest levels of education obtained by the employees are graduate training for 10% of the men, undergraduate training for 30% of the men, and high school training for 60% of the men. The highest levels of education obtained are also graduate training for 15% of the women, undergraduate training for 40% of the women, and high school training for 45% of the women.

a. (1 mark) What is the probability that a randomly chosen employee will have graduate training?

b. (1 mark) What is the probability that a randomly chosen employee who has graduate training is a man?

Question 2. (2 marks) A company specializes in installing and servicing central-heating furnaces. In the prewinter period, service calls may result in an order for a new furnace. The following table shows estimated probabilities for the numbers of new furnace orders generated in this way in the last two weeks of September.

Weight in pounds	44	45	46	47	48	49	50
Proportion of bags	0,04	0,13	0,21	0,29	0,20	0,10	0,03

a. (0,5 marks) Calculate the cumulative probability distribution.

b. (0,5 marks) What is the probability that a randomly chosen bag will contain more than 45 and less than 49 pounds?

c. (1 mark) Compute the mean and standard deviation of the weight per bag.

Question 3. (1 mark) Records indicate that, on average, 3.2 breakdowns per day occur on an urban highway during the morning rush hour. Find the probability that on any given day there will be more than 4 breakdowns on this highway during the morning rush hour.

Question 4. (2 marks) Given the probability density function of a random variable X

$$f(x)=\begin{cases}1;\ for\ \ x\in[0,1]\\ 0;\ for\ x\notin[0,1]\end{cases}$$

a. (1 mark) Find the probability that X is between 0,2 and 0,8.

b. (1 mark) Compute the mean of X .

Question 5. (2 marks) The number of hits per day on the Web site of Professional Tool, Inc., is normally distributed with a mean of 700 and a standard deviation of 120.

a. (1 mark) What proportion of days has between 730 and 820 hits?

b. (1 mark) Find the number of hits such that only 5% of the days will have the number of hits below this number.

Question 6. (1 mark) There are 3 identical boxes. The first box contains 10 products including 4 defective products, the second box contains 15 products including 5 defective products, the third box contains 20 products, including 5 defective products. Take a box at random and from there take a product at random. Find the probability of getting the defective product.

SAMPLE 2

Question 1. (2 marks) An insurance company estimated that 30% of all automobile accidents were partly caused by weather conditions and that 20% of all automobile accidents involved bodily injury. Further, of those accidents that involved bodily injury, 40% were partly caused by weather conditions.

a. (1 mark) What is the probability that a randomly chosen accident both was partly caused by weather conditions and involved bodily injury?

b. (1 mark) If a randomly chosen accident was partly caused by weather conditions, what is the probability that it involved bodily injury?

Question 2. (2 marks) A box has 10 products, including 4 defective products. Pick 2 products at random. Let X be the number of defective products taken out.

a. (1 mark) Establish a probability distribution table of X.

b. (1 mark) Calculate the mean and variance of X.

Question 3. (2 marks) A state senator believes that 25% of all senators on the Finance Committee will strongly support the tax proposal she wishes to advance. Suppose that this belief is correct and that 5 senators are approached at random.

a. (1 mark) What is the probability that at least 1 of the 5 will strongly support the proposal?

b. (1 mark) What is the probability that all of the 5 will strongly support the proposal?

Question 4. (1 mark) An author receives a contract from a publisher, according to which she is to be paid a fixed sum of $10,000 plus $1.50 for each copy of her book sold. Her uncertainty about total sales of the book can be represented by a random variable with a mean of 30,000 and a standard deviation of 8,000. Find the mean and standard deviation of the total payments she will receive.

Question 5. (2 marks) A contractor has concluded from his experience that the cost of building a luxury home is a normally distributed random variable with a mean of $500,000 and a standard deviation of $50,000.

a. (1 mark) What is the probability that the cost of building a home will be between $460,000 and $540,000?

b. (1 mark) The probability is 0.2 that the cost of building will be less than what amount?

Question 6. (1 mark) The probability of a target being hit by a person is 0.8. That person was given each bullet until it hit the target. Find the probability distribution of the number of missed bullets?

SAMPLE 3

Question 1. (2 marks) Staff, Inc., a management consulting company, is surveying the personnel of Acme Ltd. It determined that 35% of the analysts have an MBA and that 40% of all analysts are over age 35. Further, of those who have an MBA, 30% are over age 35.

a. (1 mark) What is the probability that a randomly chosen analyst who is over age 35 does not have an MBA?

b. (0,5 marks) Are the events MBA and over age 35 independent?

c. (0,5 marks) Are the events MBA and over age 35 mutually exclusive?

Question 2. (2 marks) A municipal bus company has started operations in a new subdivision. Records were kept on the numbers of riders on one bus route during the early-morning weekday service. The accompanying table shows proportions over all weekdays.

Number of riders	20	21	22	23	24	25	26	27
Proportion	0,02	0,12	0,23	0,31	0,19	0,08	0,03	0,02

a. (0,5 marks) Calculate the cumulative probability distribution.

b. (0,5 marks) What is the probability that on a randomly chosen weekday there will be at least 24 riders from the subdivision on this service?

c. (1 mark) If the cost of a ride is $1.50, find the mean and standard deviation of the total payments of riders from this subdivision on this service on a weekday.

Question 3. (1 mark) Customers arrive at a photocopying machine at an average rate of 2 every five minutes. Assume that these arrivals are independent, with a constant arrival rate, and that this problem follows a Poisson model. Find the probability that more than two customers arrive in a 5-minute period.

Question 4. (2 marks) Given the density function of a random variable X .

$$f(x) = \begin{cases} 5(1-x)^4 & \text{khi x} \in (0,1) \\ 0 & \text{khi x} \notin (0,1) \end{cases}$$

a. (1 mark) Find the probability that X is greater than 0,5.

b. (1 mark) Find the expected value of X .

Question 5. (2 marks) Scores on an achievement test are known to be normally distributed with a mean of 420 and a standard deviation of 80.

a. (1 mark) For a randomly chosen person taking this test, what is the probability of a score between 400 and 480?

b. (1 mark) What is the minimum test score needed in order to be in the top 10% of all people taking the test?

Question 6. (1 mark) A box contains 15 light bulbs, including 9 new bulbs and 6 used bulbs. The first time, people randomly take 3 balls from 15 balls to use, then return them to the box. The second time, randomly select 3 bulbs from these 15 bulbs. Find the probability that the number of new bulbs in the second time is one.

SAMPLE 4

Question 1. (2 marks) A restaurant manager classifies customers as regular, occasional, or new, and finds that of all customers 50%, 40%, and 10%, respectively, fall into these categories. The manager found that wine was ordered by 70% of the regular customers, by 50% of the occasional customers, and by 30% of the new customers.

a. (1 mark) What is the probability that a randomly chosen customer orders wine?

b. (1 mark) If wine is ordered, what is the probability that the person ordering is an occasional customer?

Question 2. (2 marks) A factory manager is considering whether to replace a temperamental machine. A review of past records indicates the following probability distribution for the number of breakdowns of this machine in a week.

Number of breakdowns	0	1	2	3	4
Probability	0,10	0,26	0,42	0,16	0,06

a. (1 mark) Find the mean and standard deviation of the number of weekly breakdowns.

b. (1 mark) It is estimated that each breakdown costs the company $1,500 in lost output. Find the mean and standard deviation of the weekly cost to the company from breakdowns of this machine.

Question 3. (1 mark) A company receives a very large shipment of components. A random sample of 16 of these components will be checked, and the shipment will be accepted if fewer than 2 of these components are defective. Suppose that the shipment has a 15% defect rate. What is the probability of accepting a shipment?

Question 4. (2 marks) Given the density function of a random variable X

$$f(x) = \begin{cases} 4x^3 \; if \; 0 \le x \le 1 \\ 0 \quad if \; x \notin [0,1] \end{cases}$$

a. (1 mark) Find the probability that X is less than 0,25.

b. (1 mark) Find the mean of X .

Question 5. (2 marks) A company services copiers. A review of its records shows that the time taken for a service call can be represented by a normal random variable with a mean of 75 minutes and a standard deviation of 20 minutes.

a. (1 mark) What proportion of service calls takes less than 1 hour?

b. (1 mark) The probability is 0.1 that a service call takes more than how many minutes?

Question 6. (1 mark) A sealed box contains 4 red cards, 4 black cards and 6 white cards. Randomly take 3 cards from the box. Suppose that you will get +1 point for each red card, -1 point for each black card, 0 point for each white card. Find the probability that you will get only 1 point.