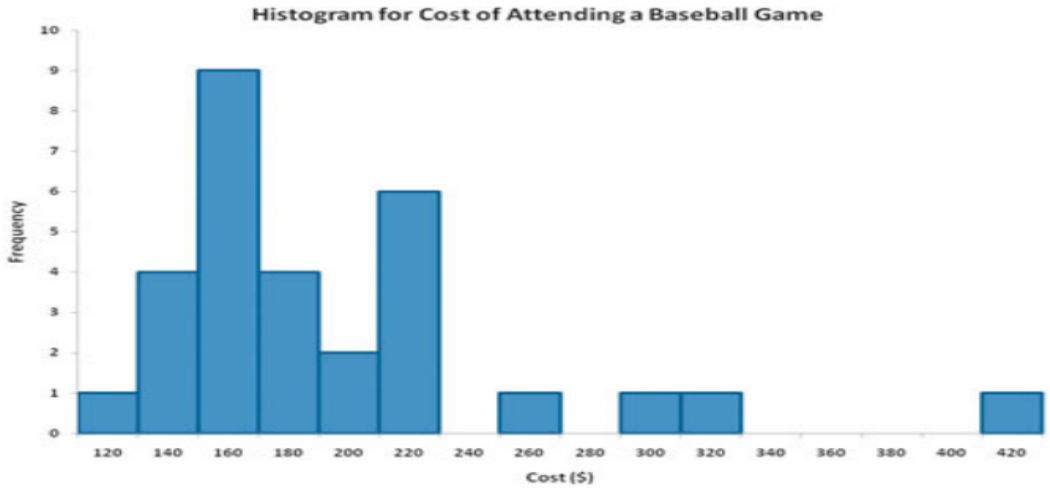
KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DHAHRAN, SAUDI ARABIA
DEPARTMENT OF MATHEMATICS

STAT 214: STATISTICAL METHODS FOR ACTUARIES
Term 231, Major Exam 1, Monday October 9, 2023, 7:00PM-8:30PM

Name: ID #:

Part 1: (30points)

1. As player salaries have increased, the cost of attending baseball games has increased dramatically. The following histogram visualizes the total cost ($) for four tickets, two beers, four soft drinks, four hot dogs, two game programs, two baseball caps, and parking for one vehicle at each of the 30 Major League Baseball parks during the 2009 season that is displayed in the following Figure:



What is the cumulative frequency of the cost of attending a baseball game at different ballparks less than $170?

a. 5
b. 14
c. 23
d. 9
e. 4

2. he following is a stem-and-leaf display representing the amount of gasoline purchased, in gallons (with leaves in tenths of gallons), for a sample of 25 cars that use a particular service station on the New Jersey Turnpike:

9	147
10	02238
11	125566777
12	223489
13	02

Compute the median

a. 116.5

b. 11.6
c. 11.7
d. 117
e. 116

3. The following data contain the cost per ounce ($) for a sample of 7 dark chocolate bars:

0.68, 0.72, 0.92, 1.14, 1.42, 0.94, 0.77.

Compute the coefficient of variation.

a. 357.67%
b. 94.14%
c. 26.32%
d. 27.96%
e. 30.4%

4. According to a Gallup Poll, the extent to which employees are engaged with their work-place varies from country to country. Gallup reports that the percentage of U.S. workers engaged with their workplace is more than twice as high as the percentage of German workers. The study also shows that having more engaged workers leads to increased innovation, productivity, and profitability, as well as reduced employee turnover. The results of the poll are summarized in the following table:

	COUNTRY		
ENGAGEMENT	United States	Germany	Total
Engaged	550	246	796
Not engaged	1,345	1,649	2,994
Total	1,895	1,895	3,790

Source: Data extracted from M. Nink, "Employee Disengagement Plagues Germany," *Gallup Management Journal*, **gmj.gallup.com**, April 9, 2009.

Given that the worker is from Germany, what is the probability that the worker is engaged?

a. $\frac{246}{3790}$
b. $\frac{1895}{3790}$
c. $\frac{246}{1895}$
d. $\frac{246}{796}$
e. $\frac{796}{1895}$

5. Olive Construction Company is determining whether it should submit a bid for a new shopping center. In the past, Olive's main competitor, Base Construction Company, has submitted bids 70% of the time. If Base Construction Company does not bid on a job, the probability that Olive Construction Company will get the job is 0.50. If Base Construction Company bids on a job, the probability that Olive Construction Company will get the job is 0.25. What is the probability that Olive Construction Company will get the job?

A. 0.4615
B. 0.15
C. 0.325
D. 0.3
E. 0.75

6. The following table contains the probability distribution for the number of traffic accidents daily in a small city:

Number of Accidents Daily (X)	$P(X = x_i)$
0	0.10
1	0.20
2	0.45
3	0.15
4	0.05
5	0.05

Calculate the standard deviation.

a. 5.4
b. 1.1832
c. 2
d. 2.23
e. 1.45

7. If $n = 10$ and $\pi = 0.70$, then the standard deviation of the binomial distribution is
   a. 0.07
   b. 1.45
   c. 7.00
   d. 14.29
   e. 0.93

8. What type of probability distribution will the consulting firm most likely employ to analyze the insurance claims in the following problem?

   An insurance company has called a consulting firm to determine if the company has an unusually high number of false insurance claims. It is known that the industry proportion for false claims is 3%. The consulting firm has decided to randomly and independently sample 100 of the company's insurance claims. They believe the number of these 100 that are false will yield the information the company desires.
   a. binomial distribution.
   b. Poisson distribution.
   c. hypergeometric distribution.
   d. Geometric distribution
   e. none of the above.

9. According to a survey of American households, the probability that the residents own 2 cars if annual household income is over $50,000 is 80%. Of the households surveyed, 60% had incomes over $50,000 and 70% had 2 cars. The probability that annual household income is over $50,000 if the residents of a household do not own 2 cars is:
    a. 0.12
    b. 0.18
    c. 0.40
    d. 0.70
    e. 0.30

10. In left-skewed distributions, which of the following is the correct statement?
    a. The distance from Q_1 to Q_2 is smaller than the distance from Q_2 to Q_3.
    b. The distance from the smallest observation to Q_1 is larger than the distance from Q_3 to the largest observation.
    c. The distance from the smallest observation to Q_2 is less than the distance from Q_2 to the largest observation.
    d. The distance from Q_1 to Q_3 is twice the distance from the Q_1 to Q_2.
    e. None of the above

Part 2:

1. The following data contain the overall miles per gallon (MPG) of 2010 small SUVs:

24	23	22	21	22	22	18	18	26
26	26	19	19	19	21	21	21	21
21	18	19	21	22	22	16	16	

a. Compute the first quartile the third quartile and the interquartile range. **(4 points)**

b. Construct a boxplot and describe its shape. **(5 points)**

c. Starting from 15, construct a grouped frequency distribution for the data with exactly 6 classes. **(6 points)**

d. Construct a relative frequency histogram for these data. Comment on the graph. **(5 points)**

2. An advertising executive is studying television viewing habits of married men and women during prime-time hours. Based on past viewing records, the executive has determined that during prime time, husbands are watching television 60% of the time. When the husband is watching television, 40% of the time the wife is also watching. When the husband is not watching television, 30% of the time the wife is watching television.

   a. Find the probability that if the wife is watching television, the husband is also watching television. **(6 points)**

   b. Find the probability that the wife is watching television during prime time. **(4 points)**

3. The quality control manager of Marilyn's Cookies is inspecting a batch of chocolate-chip cookies that has just been baked. If the production process is in control, the mean number of chip parts per cookie is 6.0. What is the probability that in any particular cookie being inspected if,

   a. fewer than five chip parts will be found? **(5 points)**

   b. either four or five chip parts will be found? **(5 points)**

4.

a. In late 2007, it was reported that 79% of U.S. adults owned a cell phone (data extracted from E. C. Baig, "Tips Help Navigate Tech-Buying Maze," USA Today, November 28, 2007, p. 5B). Suppose that by the end of 2009, that percentage was 85%. If a sample of 10 U.S. adults is selected, what is the probability that at least 8 own a cell phone? **(5 points)**

b. The dean of a business school wishes to form an executive committee of 5 from among the 40 tenured faculty members at the school. The selection is to be random, and at the school there are 8 tenured faculty members in accounting. What is the probability that the committee will contain at least one of them? **(5 points)**

With Best Wishes

Formula Sheet for Major 1

- $\bar{x} = \frac{\sum x}{n}, \quad S = \sqrt{\frac{\sum\left(x - \bar{x}\right)^2}{n-1}} = \sqrt{\frac{\sum x^2 - n(\bar{x})^2}{n-1}}, \quad C.V = \frac{S}{\bar{x}}100\%$
- $\boldsymbol{C.S = \frac{3(\bar{x} - median)}{s}}$
- $P_\alpha = X_{(i)} + d\left(X_{(i+!)} - X_{(i)}\right) \quad where \quad R_\alpha = \frac{\alpha(n+1)}{100}$
- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A|B) = \frac{P(A \cap B)}{P(B)}, P(B) > 0$
- $P\left(A_j|B\right) = \frac{P\left(A_j \cap B\right)}{P(B)} = \frac{P(A_j)P\left(B|A_j\right)}{\sum_{i=1}^{k} P(A_i)P(B|A_i)}, \quad j = 1, 2, \ldots, k$

- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A|B) = \frac{P(A \cap B)}{P(B)}, P(B) > 0$
- $P(A_j|B) = \frac{P(A_j \cap B)}{P(B)} = \frac{P(A_j)P(B|A_j)}{\sum_{i=1}^{k} P(A_i)P(B|A_i)}, \quad j = 1, 2, \ldots, k$
  - $\mu = E(X) = \sum xP(X = x)$
  - $\sigma^2 = E(X - \mu)^2 = E(X)^2 - \left(E(X)\right)^2$
  - $P(X = x) = C_x^n \pi^x (1 - \pi)^{n-x}, \; x = 0, 1, 2, \ldots, n, \quad \mu = n\pi \;\&\; \sigma = \sqrt{n\pi(1 - \pi)}$
  - $P(X = x) = \frac{C_x^K C_{n-x}^{N-K}}{C_n^N}, \; x = \{0, \cdots, min(K, n)\}, \; \mu = n\frac{K}{N} \;\&\; \sigma = \sqrt{n\frac{K}{N}\left(1 - \frac{K}{N}\right)}\sqrt{\frac{N-n}{N-1}}$
  - $P(X = x) = \frac{(\lambda t)^x e^{-\lambda t}}{x!}, x = 0, 1, 2, \ldots; \quad \mu = \lambda t \;\&\; \sigma = \sqrt{\lambda t}$