



Answer the following questions. The full credit is 60. The Exam is in **seven** Pages

**Question (1) (8 points)**

- A.** Two fair 6-sided dice are rolled. What is the probability that their sum is 7 or exactly one die is 2.

**B. MULTIPLE CHOICE:** Choose the correct answer and fill in the following table (Only one choice)

1	2	3	4	5	6

- Categorical data can be distinguished to:
  - Binomial and Normal.
  - Nominal and Ordinal.
  - Discrete and Continuous.
  - Simple and Random.
- When is the point estimate at the center of the CI (confidence interval)?
  - It is never at the center of the CI.
  - It is at the center of the CI when you estimate  $\sigma$  but not at the center of the CI when you estimate  $\mu$ .
  - It is at the center of the CI when you estimate  $\mu$  but not at the center of the CI when you estimate  $\sigma$ .
  - It is at the center of the CI when you estimate  $\mu$  and when you estimate  $\sigma$
- Under what circumstances could you use the normal approximation to the binomial?
  - It is an interval containing 99% of the data.
  - Either  $np \geq 5$  or  $nq \geq 5$ .
  - Both  $np \geq 5$  and  $nq \geq 5$ .
  - The mean is at least 5 and the standard deviation is at least 5.

4. What is the difference between mean and median of a set of data?
- The mean is the arithmetic average of the data values while the median is the middle value when the original data values are arranged in order of increasing (or decreasing).
  - The mean is the arithmetic average of the data values while the median is the average of the largest and smallest data values.
  - The mean is the average of the largest and smallest data values while the median is the middle value when the original data values are arranged in order of increasing (or decreasing) magnitude.
  - The mean is the arithmetic average of the data values while the median is the square of the mean.
5. What is the best definition for the term Central Limit Theorem?
- It means that the central value (or mean) of a standard normal distribution is 0 and the curve is symmetric.
  - It means that a probability distribution has a central value equal to the population standard deviation divided by the square root of the sample size.
  - It means that a sampling distribution will be normal if the original population is normally distributed, or if the sample size is greater than 30.
  - It means that the sample size must be greater than 30 if we want the limit sample mean to be equal to the population mean.
6. What is a Type-II error in hypothesis testing?
- A Type-II error occurs when the test statistic happens to be outside the critical region.
  - A Type-II error occurs when the null hypothesis is accepted when, in fact, the null hypothesis is false.
  - A Type-II error occurs when the null hypothesis is rejected when, in fact, the null hypothesis is true.
  - A Type-II error occurs when the P-value exceeds the significance level  $\alpha$ .

**Question (2) (24 points)**

**A.** Listed below are the numbers of births in a city, for each month in a certain year:

38 65 91 72 56 49 44 87 68 79 40 60

Find the following measures for this sample (round off to one decimal place):

**Mean :**

**Median:**

**Mode:**

**Midrange:**

**Range:**

**Minimum usual value :**

**Maximum usual value :**

**Variance:**

**St. Deviation:**

**B.** A sample of ten voltage levels is obtained. Construction of a confidence interval for the population standard deviation  $\sigma$  requires the left and right critical values of  $\chi^2$  corresponding to a confidence level of 95% and a sample size of  $n = 10$ .

a. Find the critical value of  $\chi^2$  separating an area of 0.025 in the left tail.

b. Find the critical value of  $\chi^2$  separating an area of 0.025 in the right tail.

**C.** Assume that 20% of all donors have blood that is Group A. A sample of 60 donors is randomly selected.

a. Find the mean  $\mu$  and the standard deviation  $\sigma$  for the number of donors in the selected sample that have blood of Group A. (Keep three decimal places.)

b. Why can you approximate this Binomial to Normal?

**For (c) and (d) Use the Normal Approximation to Binomial. (Do not forget continuity correction!) Draw a diagram.**

c. Find the probability that fewer than 10 of the selected donors have blood of Group A.

d. Find the probability that exactly 10 of the selected donors have blood that is Group A. You can use either binomial probabilities or normal approximation.

**Question (3) (8 points)**

**D.** Assume that adults have IQ scores that are normally distributed with a mean of 100 and a standard deviation of 13. Answer the questions below by using Table A-2. Draw diagrams to help you.

- a. Find the probability that the IQ of a randomly selected adult is at least 89.
  
  
  
  
  
  
  
  
  
  
- b. Find the IQ score separating the top 20% from the bottom 80% of adults.
  
  
  
  
  
  
  
  
  
  
- c. If 35 adults are randomly selected, find the probability that their average IQ score is between 97 and 102. (Use the Central Limit Theorem.)
  
  
  
  
  
  
  
  
  
  
- d. Give two different reasons why in question (c) you can use the Central Limit Theorem.

**Question 4 (12 points)**

- A.** For the following discrete probability distribution; First, find the missing value. Then, Find the mean and Standard deviation

X	0	1	2	3	4
P(x)	0.10	0.15	0.45	0.20	?

- B.** When 12 different medical students measured the blood pressure of the same person, they obtained the following results (in mmHg)

122 141 135 129 131 125 140 121 137 130 128  
136

Assume that the population has normal distribution and its standard deviation is known to be 6 mmHg.

- Give the best point estimate of the population mean.
- Give the margin of error. Explain how you computed it.
- Construct a 99% confidence interval for the population mean. Show your work.
- Construct a 90% confidence interval for the population mean. Which interval is bigger? Why?

**Question (5) (12 points)**

**A.** Among 400 adults asked if they use Aspirin, 74 answered yes. Use a 0.1 significance level to test the claim that 20% of the population use Aspirin.

a. State the null and the alternative hypotheses.

b. Compute the test statistic.

c. Draw a diagram. Find and mark the critical value(s).

d. Make an initial conclusion (about the hypothesis) and a final conclusion about your claim.

**B.** Listed below are the measurements of the blood pressure of six subjects taken on their right arm and left arm. Use the pressure in the right arm as the x variable and the pressure in the left arm as the y variable.

Right arm: 112 106 101 99 104 98

Left arm: 125 103 102 109 103 104

Find the linear correlation coefficient. (Round off to three decimal places.)