ECO 202 (Assignment-1)

Summer, 2025

Instructions:

(i)   This is a group assignment (maximum 4 members in a group)
(ii)   You are required to submit the hard copy of the assignment in person
(iii) Submission Deadline: July 29, 2025 (in-class)

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1. A production manager knows that 5% of components produced by a particular manufacturing process have some defect. Six of these components, whose characteristics can be assumed to be independent of each other, are examined.
   a. What is the probability that none of these components has a defect?
   b. What is the probability that one of these components has a defect?
   c. What is the probability that at least two of these components have a defect?

2. A state has a law requiring motorists to carry insurance. It was estimated that, despite this law, 6.0% of all motorists in the state are uninsured. A random sample of 100 motorists was taken. Use the Poisson approximation to the binomial distribution to estimate the probability that at least 3 of the motorists in this sample are uninsured.

3.

Consider the joint probability distribution:

		X	
		1	2
Y	0	0.30	0.20
	1	0.25	0.25

   a. Compute the marginal probability distributions for X and Y.
   b. Compute the covariance and correlation for X and Y.
   c. Compute the mean and variance for the linear function $W = 2X + Y$.

4. A contractor estimates the probabilities for the number of days required to complete a certain type of construction project as follows:

Time (days)	1	2	3	4	5
Probability	0.05	0.20	0.35	0.30	0.10

   a. What is the probability that a randomly chosen project will take less than 3 days to complete?
   b. Find the expected time to complete a project.
   c. Find the standard deviation of time required to complete a project.
   d. The contractor's project cost is made up of two parts—a fixed cost of $20,000, plus $2,000 for each day taken to complete the project. Find the mean and standard deviation of total project cost.
   e. If three projects are undertaken, what is the probability that at least two of them will take at least 4 days to complete, assuming independence of individual project completion times?

5. 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. What is the probability that the cost of building a home will be between $460,000 and $540,000?
   b. The probability is 0.2 that the cost of building will be less than what amount?

6. For an audience of 600 people attending a concert, the average time on the journey to the concert was 32 minutes, and the standard deviation was 10 minutes. A random sample of 150 audience members was taken.
   a. What is the probability that the sample mean journey time was more than 31 minutes?
   b. What is the probability that the sample mean journey time was less than 33 minutes?
   c. Construct a graph to illustrate why the answers to parts (a) and (b) are the same.
   d. What is the probability that the sample mean journey time was not between 31 and 33 minutes?

7. A charity has found that 42% of all donors from last year will donate again this year. A random sample of 300 donors from last year was taken.
   a. What is the standard error of the sample proportion who will donate again this year?
   b. What is the probability that more than half of these sample members will donate again this year?
   c. What is the probability that the sample proportion is between 0.40 and 0.45?

8. The times spent studying by students in the week before final exams follows a normal distribution with standard deviation 8 hours. A random sample of four students was taken in order to estimate the mean study time for the population of all students.
   a. What is the probability that the sample mean exceeds the population mean by more than 2 hours?
   b. What is the probability that the sample mean is more than 3 hours below the population mean?
   c. What is the probability that the sample mean differs from the population mean by more than 4 hours?