

Instructions: Please include your work to get full credit and write your solutions neatly. Make sure that you round off the decimal values correctly. Encircle your final answers.

1. Let X be the number of cars that Linda sells on a typical Saturday. The probability distribution for X is given below

Car sold (x)	0	1	2	3	4
Probability	0.15	0.4	0.25	0.15	0.05

- **a.** What is the probability that on a typical Saturday, Linda will sell at least 2 cars? [3]
- **b.** Find the mean (μ_X) and standard deviation (σ_X) of X.

- c. If Linda is paid \$50 per day and earns a commission of \$250 for each car she sells, what is her expected earning on a typical Saturday? [3]
- **d.** If Linda is given a choice to earn \$100 per day but with a lower commission of \$200 for each car she sells, determine which choice (compared to that of part **c**) is better in the long run. [4]
- 2. A company that produces fine crystal knows from experience that 10% of its goblets have cosmetic flaws and must be classified as "seconds." Among six randomly selected goblets, what is the probability that
 - **a.** not one is a second?

[4]

[6]

- **3.** In response to concerns about nutritional contents of fast foods, McDonald's has announced that it will use a new cooking oil for its french fires that will decrease substantially trans fatty acid levels and increase the amount of more beneficial poly-unsaturated fat. The company claims that 97 out of 100 people cannot detect a difference in taste between the new and old oils. Assuming that this figure is correct (as a long-run proportion), and let X denote the number of people who can tell the difference between the two oils out of a random sample of 1000 individuals who purchased fries at McDonald's,
 - **a.** Determine the exact distribution of X. Specify all known distribution parameter values. [3]
 - **b.** Explain why the normal distribution can be used to approximate this distribution, then give parameter values of the approximate normal distribution. [3]
 - c. Approximate the probability that at least 40 people (out of the 1000) can tell the difference between the two oils.

d. Approximate the probability that between 20 to 34 (inclusive) can tell the difference between the two oils.

4. The average hourly wage of fast-food workers employed by a nationwide chain is \$6.75 and the standard deviation is \$1.15. Assume that the hourly wage is normally distributed.

a.	Then about 68% of all such workers earn between	_ and	dollars
	per hour.		[2]
b.	What proportion of these workers make at least \$7.00 per hour?		[4]

d. Under these conditions, how much should your hourly wage be in order to be in the top 10% among such workers? [4]

- e. If 25 of these workers are randomly selected and let \bar{X} represent the average salary of these 25 workers, what is the exact distribution of \bar{X} ? Specify all known parameters. [3]
- f. What is the probability that the average hourly wage of those 25 workers isi. at least \$7.00 per hour. [4]

ii. between \$6.00 to \$7.00 per hour?

- 5. There are two machines $(M_1 \text{ and } M_2)$ available for cutting corks intended for use in wine bottles. Machine M_1 produces corks with diameters that are normally distributed with mean 3 cm and standard deviation 0.06 cm. Machine M_2 produces corks with diameters that have a normal distribution with mean 3.04 cm and a standard deviation 0.02 cm.
 - **a.** If a cork is randomly selected from M_1 , what is the probability that the diameter of this cork is longer than 3.05 cm? [4]

 $\left[5\right]$

b. If a cork is randomly selected from M_2 , what is the probability that the diameter of this cork is longer than 3.05 cm? [4]

c. If acceptable corks have diameters between 2.9 cm and 3.1 cm, compute the proportions of acceptable corks produced by M_1 and M_2 . Which machine is more likely to produce an acceptable cork? [7]

d. If 16 corks from M_1 are randomly selected, what is the probability the the average diameter of these 16 corks is bigger than 3.05 cm? [6]

- 6. The scores of high school seniors on the ACT college entrance examination in 2003 had a mean of 20.6 and standard deviation of 4.8. If a random sample of 36 students is selected
 - a. What can you say about the distribution of the average of the scores of these 36 students? What result guarantees the veracity of your statement? Don't forget to include the appropriate parameter values

b. What is the probability that the average score of the 36 students is lower than 18? [6]

7. Answer the following questions with at most 3 sentences.

a. Explain the difference between a parameter and a statistic? Give 2 examples of each.

Bonus. State the Central Limit Theorem. You may use your own words.