(4)  1. Answer True (T) or False (F):

    (a) _____The thickness of a book in a library is a discrete variable.

    (b) _____Both Chebyshev's Theorem and The Empirical rule can be used in any distribution.

    (c) _____Circle graphs and bar graphs are used to summarize qualitative data.

    (d) _____If two events are not independent, they are not mutually exclusive.

    (e) _____In a sample, $P_{30}$ is a number such at at most 30% of the data are smaller in value than $P_{30}$.

    (f) _____In the Poisson distribution, $\sigma = \mu^2$.

    (g) _____The Central Limit Theorem says that the sampling distribution of sample means will more closely resemble the normal distribution as the sample size increases.

    (h) _____The maximum error of estimate is controlled by three factors: level of confidence, sample size and standard deviation.

(8)  2. In a small library with a collection of 109870 books, a sample of 1000 books were randomly selected and their prices were checked. From this group a mean of $46.72 was computed. Match the items in Column II with the statistical terms in Column I.

| Column I | Column II |
|---|---|
| _____ Data (one) | (a) *The computed* $46.72 |
| _____ Data (set) | (b) *The collection of* 109870 *books* |
| _____Experiment | (c) *The* 1000 *books* |
| _____Parameter | (d) *The prices of the* 1000 *books* |
| _____Population | (e) *The price of one book* |
| _____Sample | (f) *The mean price of all books in the library* |
| _____Statistic | (g) $50.99 *of one book* |
| _____Variable | (h) *The process used to select the* 1000 *books* |

(4)  3. A department wants to select a committee of 6 people from 6 females and 5 males.

    (a) How many different committees are possible?

    (b) How many different committees are possible if the committee must contains exactly 3 females and 3 males?

(4)   4. For two events $A$ and $B$, $P(A) = 0.3$, $P(B) = 0.4$ and $P(A \cup B) = 0.6$. Find

   (a) $P(A \cap B)$

   (b) $P(A|B)$

   (c) Are $A$ and $B$ independent? Justify your answer.

(10)   5. A dozen eggs has the following calibers in millimeters: .

$$50, \ 55, \ 60, \ 55, \ 65, \ 64, \ 55, \ 55, \ 47, \ 48, \ 49, \ 52$$

   (a) Rank the data and find the mean, median, mode, and range.

   (b) Give the 5-number summary and draw a box and whiskers plot.

(15)   6. A sample of 100 woodpeckers are observed to see how many worms they can eat. The following table gives the frequency distribution:

| # of worms (Class limits) | # of woodpeckers $f$ | Class Mark $x$ | $xf$ | $x^2 f$ | Cumulative Frequency | Cumulative Rel. Frequency |
|---|---|---|---|---|---|---|
| 0–10 | 10 | | | | | |
| 10–20 | 20 | | | | | |
| 20–30 | 38 | | | | | |
| 30–40 | 24 | | | | | |
| 40–50 | 8 | | | | | |

   (a) Complete the table above and find the mean and standard deviation for this distribution.

   (b) Draw a histogram and ogive for this distribution.

(3)   7. In a survey of 210 people in the age group 50–65, the following data were obtained relating weight to diabetes:

| | Overweight | Normal weight |
|---|---|---|
| Diabetes | 71 | 20 |
| Non-diabetes | 10 | 109 |

   Suppose a 60-65 year-old person is randomly selected from this particular population.

   (a) What is the probability that the person has diabetes?

   (b) What is the probability that the person is not overweight?

   (c) What is the probability that the person has diabetes given that the person is overweight?

(3)   8. For a particular sample of 100 fish, the following results were obtained about the weights of the fish (in grams):

$$\text{Mean} = 210 \quad \text{Standard deviation} = 21$$

(a) If we assume **nothing** about the shape of the distribution, approximately what percentage of all weights are between 168 and 252 grams?

(b) Suppose a new sample is formed by adding 5 to every item of data in the original sample. Find the standard deviation of the new sample.

(6)  9. Consider the following discrete probability distribution:

| x    | 0    | 1    | 2    | 3    | 4    |
|------|------|------|------|------|------|
| p(x) | 0.73 | 0.16 | 0.06 | 0.04 | 0.01 |

(a) Find the mean and the standard deviation, using an extension table.

(b) What is the probability that $x$ is between $\mu - \sigma$ and $\mu + \sigma$?

(5) 10. Magnetic resonance imaging (MRI) is a process that produces internal body images using a strong magnetic field. Some patients become claustrophobic and require a sedation because they are required to lie within a small enclosed space. Suppose that 20% of all patients undergoing MRI require sedation due to claustrophobia. If 5 patients are selected at random, find the probability that

(a) none of these patients require a sedation

(b) exactly 2 patients require a sedation

(c) at most 3 patients require a sedation

(4) 11. A university police department receives an average of 3.7 reports per week for lost student ID cards. Use Poisson distribution to find the probability that during a given week

(a) exactly 2 reports will be received

(b) at least 3 reports will be received

(6) 12. Draw a picture, shade the area which is represented, and evaluate:

(a) $P(z > 1.43)$

(b) $P(z < 1.65)$

(c) $P(-1.56 < z < 2.31)$

(d) $t(12, 0.01)$

(e) $t(14, 0.95)$

(f) If $P(-1.2 < z < z_0) = 0.8675$, what is $z_0$?

(4) 13. Suppose that $x$ is normally distributed with mean 85 and standard deviation 23.

(a) What is the probability that $x$ is greater than 123.87?

(b) What value of $x$ does only the top 20% exceed?

(4) 14. According to a 4-year study, 25% of bottled-water brands fill their bottles with just tap water. In a random sample of 65 bottled water , let $x$ be the number that contain tap water. Find the approximate probability that 20 or more of the sampled bottled-water brands will contain tap water. (Hint: Use the normal approximation to binomial distribution.)

(4) 15. The diameters of grapefruit in a certain orchard are normally distributed with mean 4.6 inches and standard deviation 1.3 inches. If a random sample of 10 of these grapefruits are put in a bag and sold in a grocery store, what is the probability that the mean diameter, $\bar{x}$, of this sample will be

   (a) smaller than 4 inches?

   (b) between 4 inches and 5 inches?

(4) 16. An anthropologist measured the heights of a random sample of 40 adult males native to a south pacific island. The average height of this sample was 57.6 inches. The population standard deviation is 3.7 inches.

   (a) Give the point estimate for $\mu$, the mean height of the adult males.

   (b) Find the 90% confidence interval for $\mu$.

(4) 17. The college president asks a statistics teacher to estimate the average age of the students at their college. The teacher would like to be 99% confident that the estimate should be accurate with maximum error of *one* year. From a previous study, the standard deviation of the ages is known to be 3 years. How large a sample is necessary?

(4) 18. According to data from World Research, 21% of shoppers who never buy online said that they do not do so due to "fear of hackers". Suppose that this percentage is based on a random sample of 200 shoppers who never buy online.

   (a) What is the point estimate of the corresponding population proportion, $p$?

   (b) Find the 98% confidence interval for $p$.

(4) 19. Symptoms of a new flu virus have been determined from a sample of 18 sufferers to have a mean duration time of 9.7 days with the sample standard deviation being 4.8 days. Find a 95% confidence interval for the mean duration time of these flu symptoms. Assume the duration time is normally distributed.