Unity ID: _____ Name: _____

Instructions:

- Read each question carefully.
- Show all work to receive full credit.
- Make all work legible.
- You can keep your answers in fraction. If you use decimal points, give answers to **3 decimal places** unless specified otherwise.
- You may use any course notes, the course textbook, your previous homework and solutions, calculators, computer, and the Internet in completing the exam. Any consultation/collaboration in any form with any person other than the instructor is strictly prohibited.

Honor Pledge:

I certify that I have not received or given unauthorized aid in taking this exam.

Signed: _____

Use the following for questions 1-2:

In a certain region of the country it is known from past experience that the probability of selecting an adult over 40 years of age with cancer is 0.05. The probability of a doctor correctly diagnosing a person with cancer as having the disease is 0.78 and the probability of incorrectly diagnosing a person without cancer as having the disease is 0.06.

1. (4 points) What is the probability that an adult over 40 years of age is diagnosed as having cancer?

2. (4 points) What is the probability that a person diagnosed as having cancer actually has the disease?

Questions 3-4:

By comparing appropriate regions of Venn diagrams, verify that

3. (4 points)) $(A \cap B) \cup (A \cap B') = A$

4. $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Use the following for questions 5-8:

Before the distribution of an ASIC, a random sample of chips are tested. The testing process consists of checking four independent functions and checking the results. The failure rates for the four tests 1, 2, 3, and 4 are, respectively, 0.01, 0.03, 0.02, and 0.01.

5. (4 points) What is the probability that a chip was tested and failed any test?

6. (4 points) What is the probability that a tested ASIC fails functional test 2 or 3?

7. (4 points) In a sample of 100, how many chips would you expect to be rejected?

8. (4 points) In a sample of 100, what is the probability exactly 10 chips fail?

Use the following for questions 9-12:

Find the errors in each of the following statements:

9. (2 points) The probabilities that an automobile salesperson will sell 0, 1, 2, or 3 cars on any given day in February are, respectively, 0.19, 0.38, 0.29, and 0.15.

10. (2 points) The probability that it will rain tomorrow is 0.40, and the probability that it will not rain tomorrow is 0.52.

11. (2 points) The probabilities that a printer will make 0, 1, 2, 3, or 4 or more mistakes in setting a document are, respectively, 0.19, 0.34,−0.25, 0.43, and 0.29.

12. (2 points) On a single draw from a deck of playing cards, the probability of selecting a heart is 1/4, the probability of selecting a black card is 1/2, and the probability of selecting both a heart and a black card is 1/8.

Use the following for questions 13-14:

A manufacturer of electronic components is interested in determining the lifetime of a certain type of battery. A sample, in hours of life, is as follows:

123, 116, 122, 110, 175, 126, 125, 111, 118, 117.

13. (4 points) Find the sample mean and median.

14. (4 points) What feature in this data set is responsible for the substantial difference between the two?

Use the following for questions 15-18:

An investment firm offers its customers municipal bonds that mature after varying numbers of years. Given that the cumulative distribution function of T, the number of years to maturity for a randomly selected bond, is

$$F(t) = \begin{cases} 0, & t < 1, \\ \frac{1}{4}, & 1 \le t < 3, \\ \frac{1}{2}, & 3 \le t < 5, \\ \frac{3}{4}, & 5 \le t < 7, \\ 1, & t \ge 7, \end{cases}$$

find

15. (4 points) P(T = 5)

16. (4 points) P(T > 3)

17. (4 points) $P(1 \leq T < 6)$

18. (4 points) $P(T \leq 5 \mid T \geq 2)$

Use the following for questions 19-21:

The probability distribution of X, the number of imperfections per 10 meters of a synthetic fabric in continuous rolls of uniform width, is given in as

x	0	1	2	3	4
$f(x)$	0.41	0.37	0.16	0.05	0.01

19. (4 points) Show that f(x) is a pmf.

20. (4 points) What is the expected value of X?

21. (4 points) If the price for 10 meters of fabric is set a \$10 – \$0.5X, what is the expected price per 10 meters?

Use the following for questions 22-25:

Approximately 30% of all pipework failures in chemical plants are caused by operator error. These failures are independent.

22. (4 points) Of the next 20 pipework failures, what is the expected number that will be caused by operator error?

23. (4 points) What is the probability that out of the next 20 pipework failures at least 18 are due to operator error?

24. (4 points) What is the probability that no more than 4 out of 20 such failures are due to operator error?

25. (4 points) Suppose, for a particular plant, that out of the random sample of 20 such failures, exactly 5 are due to operator error. Do you feel that the 30% figure stated above applies to this plant? Comment.

Use the following for questions 26:

Suppose that airplane engines operate independently and fail with probability equal to 0.4. Assuming that a plane makes a safe flight if at least one-half of its engines run.

26. (4 points) Determine whether a 4-engine plane or a 2-engine plane has the higher probability for a successful flight.