

100 points. Show all work to receive full credit. You may use a calculator. CHECK YOUR WORK!!!!

THERE ARE 4 PAGES IN THIS EXAM

1. (6 pts) A bag contains 6 red marbles, 3 blue marbles, and 5 green marbles. If a marble is randomly selected from the bag, what is the probability that it is blue?

$$\boxed{\frac{3}{14}} \approx 0.214$$

2. (6 pts) Assume that a study of 500 randomly selected school bus routes showed that 485 arrived on time. Is it "unusual" for school bus to arrive late? Justify your answer. (NOTE: An event is to be considered "unusual" if its probability is less than or equal to 0.05.)

$$P(\text{LATE}) = \frac{15}{500} = 0.03 \quad 0.03 < 0.05$$

$\boxed{\text{UNUSUAL}}$

Problems 3 & 4 use the same table shown below:

The table below describes the smoking habits of a group of asthma sufferers.

	Nonsmoker	Occasional smoker	Regular smoker	Heavy smoker	Total
Men	387	45	90	37	559
Women	421	46	69	34	570
Total	808	91	159	71	1129

3. (6 pts) If one of the people is selected at random, find the probability that the person is a man or a heavy smoker. Round to the nearest thousandth.

$$P(\text{M or HS}) = P(\text{M}) + P(\text{HS}) - P(\text{M \& HS})$$

$$= \frac{559}{1129} + \frac{71}{1129} - \frac{37}{1129} = \boxed{\frac{593}{1129} \approx 0.525}$$

4. (6 pts) If one of the people is selected at random, find the probability that the person chosen is a nonsmoker given that it is a woman. Round to the nearest thousandth.

$$P(\text{NS} | \text{W}) = \boxed{\frac{421}{570} = 0.739}$$

$$P(\text{NS \& W}) / P(\text{W})$$

5. (6 pts) A bag contains 5 red marbles, 3 blue marbles, and 1 green marble. Find P(not blue).

$$1 - P(\text{BLUE}) = 1 - \frac{3}{9} = \frac{6}{9} = \boxed{\frac{2}{3} \approx 0.667}$$

6. (6 pts) A sample of 4 different calculators is randomly selected from a group containing 16 that are defective and 40 that have no defects. What is the probability that at least one of the calculators is defective?

$$\frac{40C4}{56C4} = \underline{0.751} \quad 1 - P(\text{NO DEFECTS}) \quad P(\text{NO DEFECTS}) = \frac{40C4}{56C4}$$

$$= 0.2488 \quad 1 - 0.2488 = \underline{0.7512}$$

7. (6 pts) The library is to be given 7 books as a gift. The books will be selected from a list of 19 titles. If each book selected must have a different title, how many possible selections are there?

$$19C7 = \underline{50,388}$$

2PTS IF USE $19P7$

8. (12 pts) In a certain town, 30% of the adults have a college degree. The table shown below describes the probability distribution for the number of adults (among 4 randomly selected adults) who have a college degree. Find the mean and standard deviation.

x	P(x)
0	0.2401
1	0.4116
2	0.2646
3	0.0756
4	0.0081

$$\bar{X} = \sum x P(x) = 0 + 0.4116 + 2(0.2646) + 3(0.0756) + 4(0.0081) = 1.2$$

$$\bar{X} = \underline{1.2}$$

$$\sigma = \sqrt{\frac{\sum x^2 P(x) - \mu^2}{n}}$$

(VARSTATS L1, L2 =>

$$\sigma = \underline{0.9165}$$

9. (6 pts) A contractor is considering a sale that promises a profit of \$26,000 with a probability of 0.7 or a loss (due to bad weather, strikes, and such) of \$3000 with a probability of 0.3. What is the expected profit?

$$E = \sum x P(x) = 26,000(0.7) + 0.3(-3000) = \underline{\$17,300}$$

10. (6 pts) A test consists of 10 true/false questions. To pass the test a student must answer at least 7 questions correctly. If a student guesses on each question, what is the probability that the student will pass the test?

$$P(\text{AT LEAST 7}) = 1 - P(0 \leq x \leq 6) = 1 - \text{BINOMCDF}(10, 0.5, 6)$$

$$n = 10$$

$$p = 0.5$$

$$x = 6$$

$$= 1 - \text{BINOMCDF}(10, 0.5, 6)$$

$$= 1 - 0.828125 = \underline{0.1719}$$

11. (8 pts) In a study, 42% of adults questioned reported that their health was excellent. A researcher wishes to study the health of people living close to a coal burning power plant. Among 14 adults randomly selected from this area, only 3 reported that their health was excellent. Find the probability that when 14 adults are selected, 3 or fewer are in excellent health.

$$\begin{aligned}
 n &= 14 \\
 x &= 3 \\
 p &= 0.42 \\
 P(3 \text{ or fewer}) &= P(0) + P(1) + P(2) + P(3) \\
 &= \text{BINOMCDF}(14, 0.42, 3) \\
 &= \boxed{0.0961}
 \end{aligned}$$

12. (6 pts) In a survey, 4% of the people responded saying that they never drank alcohol. What is the probability of exactly 3 people out of a sample of 64 that have never had an alcoholic drink?

$$\begin{aligned}
 P(x=3) &= \text{BINOMPDF}(64, 0.04, 3) \\
 &= \binom{64}{3} (0.04)^3 (0.96)^{61} = \boxed{0.2210}
 \end{aligned}$$

13. (6 pts) The probability is 0.7 that a person shopping at a Walmart will spend less than \$20. For groups of 22, find the mean number of people who spend less than \$20. BINOMIAL

$$\begin{aligned}
 \bar{x} &= np = (0.7)(22) \\
 &= \boxed{15.4}
 \end{aligned}$$

14. (8 pts) A survey for brand recognition is done, and it is determined that 68% of consumers have heard of Dull Computer Company. A survey of 800 randomly selected consumers is to be conducted. For groups of 800, would it be unusual to get 491 consumers who recognize the Dull Computer Company name? (NOTE: Consider as unusual any result that differs from the mean by more than 2 standard deviations - i.e. $\mu - 2\sigma$ or $\mu + 2\sigma$.)

$$\begin{aligned}
 \mu &= np = 800(0.68) = 544 \\
 \sigma &= \sqrt{npq} = \sqrt{800(0.68)(0.32)} = \sqrt{174.08} = 13.19
 \end{aligned}$$

$$491 < \mu = 544$$

$$x = \text{UNUSUAL} < \mu - 2\sigma$$

$$x < 544 - 2(13.19)$$

$$x < 517.62$$

$$491 < 517.62 \Rightarrow \boxed{\text{UNUSUAL}}$$

15. (6 pts) A company manufactures batteries in batches of 13, and there is a 3% rate of defects. Find the standard deviation for the number of defects per batch.

$$\begin{aligned} \sigma &= \sqrt{npq} = \sqrt{13(0.03)(0.97)} \\ &= \boxed{0.615} \end{aligned}$$



BONUS (10 points)



(5 pts) If a license plate consists of two letters followed by four digits, how many different licenses could be created having at least one letter or digit repeated?

$$\begin{aligned} &\overline{\text{L}} \quad \overline{\text{L}} \quad \overline{\text{D}} \quad \overline{\text{D}} \quad \overline{\text{D}} \quad \overline{\text{D}} \\ \text{AT LEAST ONE} &= \text{ALL REPEATED} - \text{NO REPEATS} \\ &= (26)(26)(10)(10)(10)(10) - (26)(25)(10)(9)(8)(7) \\ &= 676,000 - 327,600 \\ &= \boxed{3,484,000} \end{aligned}$$

(5 pts) How many ways can the letters in the word "CONNECTICUT" be arranged?

$$\begin{aligned} \frac{11!}{1! \cdot 1! \cdot 1!} &= \frac{11!}{3! \cdot 2! \cdot 2!} = \frac{11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3!}{3! \cdot 2! \cdot 2!} \\ &= 1,663,200 \\ &= \frac{39,916,800}{24} = \boxed{1,663,200} \end{aligned}$$

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