Name: _____   **Section: <u>MAT098/181C-</u>**

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*A scientific calculator is permitted. <u>**Cellphones may not be used as calculators and must**</u> <u>**be off or on vibrate during the exam**</u>. Show all work on the test or on the work paper*

MAT098/181C EXAM #2 (FORM B Key)

1. For each problem, please circle one: <u>marginal, conditional or joint probability</u>. Then write your answer as a fraction and as a percentage. Round to the nearest tenth.

	Who did Bostonian vote for in 2016?			
	Trump	**Clinton**	**Other**	**Total**
Female	11	115	7	133
Male	26	97	9	132
Total	37	212	16	265

a. What is the probability that a voter voted for Trump? *(4 pts)*
    1) **Marginal Probability**   2) Conditional Probability   3) Joint Probability

$$P(\text{Trump}) = \frac{37}{265} \approx 14.0\%$$

b. If a researcher randomly selects a female voter, what is the probability that she voted for Trump? *(4 pts)*
    1) Marginal Probability   2) **Conditional Probability**   3) Joint Probability

$$P(\text{Trump} \mid \text{Female}) = \frac{11}{133} \approx 8.3\%$$

c. If a researcher randomly selects a Trump voter, what is the probability that the voter is female? *(4 pts)*
    a. Marginal Probability   2) **Conditional Probability**   3) Joint Probability

$$P(\text{female} \mid \text{Trump}) = \frac{11}{37} \approx 29.7\%$$

d. What is the probability that a voter is a female who voted for Trump? In other words, what is the probability that a voter voted for Trump and is a female? *(4 pts)*
    1) Marginal Probability   2) Conditional Probability   3) **Joint Probability**

$$P(\text{Trump AND female}) = \frac{11}{265} \approx 4.2\%$$

2. A campaign manager was planning an advertisement. He polled the voters on their number one concern during the election. The following table represents the data that was collected. *(18 points)*

	Economy	Social Issues	Does not care	Total
Asian American	32	21	3	56
African American	18	42	2	62
Total	50	63	5	118

a) Find the probability that a randomly selected voter does not care.

$$P(\text{does not care}) = \frac{5}{118} \approx 4.2\%$$

b) Find the probability that a randomly selected voter is Asian American and concerns about the economy.

$$P(\text{asian american AND economy}) = \frac{32}{118} \approx 27.1\%$$

c) Find the probability that a randomly selected voter concerns about the economy OR does not care.

$$P(\text{economy OR does not care}) = \frac{50 + 5}{118} \approx 46.6\%$$

d) Find the probability that a randomly selected voter concerns about the social issues given they are African American.

$$P(\text{social issues | afrian american}) = \frac{42}{62} \approx 67.7\%$$

e) Find the probability that a randomly selected student is Asian American given they concern about the economy.

$$P(\text{asian american | economy}) = \frac{32}{50} = 64\%$$

f) Are African American more likely to concern about social issues than Asian American? EXPLAIN your answer by comparing probabilities.

Yes, African American $\frac{42}{62} = 68\%$ is larger than Asian American $\frac{21}{56} = 38\%$.

3. The faculty at a college collected data on a multiple choice quiz over several years. Instructors gave different students the quiz. The quiz had ten questions. *(16 points)*

   Below is a probability distribution. This probability distribution displays the probability of getting a certain number of questions correct.

x	0	1	2	3	4	5	6	7	8	9	10
P(x)	0.02	0.03	0.04	0.04	0.06	0.10	0.11	0.15	0.23	0.17	0.05
$xP(x)$	0	0.03	0.08	0.12	0.24	0.50	0.66	1.05	1.84	1.53	0.5

   a) Find the probability a student selected at random got exactly 7 questions correct on the quiz.

   $$0.15 \ or \ 15\%$$

   b) Find the probability a student selected at random got exactly 8 OR exactly 10 questions correct on the quiz.

   $$0.23 + 0.05 = 0.28 \ or \ 28\%$$

   c) Find the probability a student selected at random got less than 6 questions correct on the quiz.

   $$0.02 + 0.03 + 0.04 + 0.04 + 0.06 + 0.10 = 0.29 \ or \ 29\%$$

   d) Find the mean number of questions answered correctly using the formula.

   $$\mu = \sum x \cdot P(x) = 6.55$$

4. Jay wants to start his business with an ice cream truck. He offers 3 flavors of ice cream: chocolate, strawberry, and vanilla. The topping choices are cookie crumbs, sprinkles, and walnuts. Use a tree diagram to show how many total possible combinations Ahmed can sell. (10 points)

The diagram should have 9 combinations at the end.

5. Please use the formula & show all work. (10 points)

   (a) There are 17 soldiers in a training camp. If the drill sergeant needs to send a team of 4 soldiers for ranger training, how many different teams are possible? (10 points)

$$_{17}C_4 = \frac{17!}{4! \cdot 13!} = 2380$$

   (b) If a college basketball league has 15 teams, how many different end of the season rankings are possible for first, second, and third prizes? Assume no ties.

$$_{15}P_3 = 15 \cdot 14 \cdot 13 = 2730$$

6. An article in a journal reports that 66% of American fathers take responsibility for child care. A researcher wants to verify this rate as the city is interested in running some parenting programs. He selects a random sample of 8 fathers in town. Find the probability that exactly 5 of the 8 fathers take responsibility for child care. (15 points)

   a) Why is this a binomial distribution?

      There are a fixed number of independent trials, 8.

      There are only two possible outcomes: responsible and not responsible.

      The probability of success on one trial is 0.66 and the probability of failure is 0.34 with p + q = 1.

   b) Identify the following:

      n = **8**   p = **0.66**   q = **0.34**   r = **5**

   c) Find the probability that exactly 5 of the 8 fathers take responsibility for child care. ****Please use the formula & show all work**.

$$P(5) =_8 C_5 \cdot 0.66^5 \cdot 0.34^3 \approx 0.2756$$

7. In a research study, 70% of students graduating from four-year colleges had student loan debt. A government agency wishes to study student loan debt for Boston. Among 12 college students randomly selected from this area, only 8 reported that they had student loan debt. (15 points) ****Please use the formula & show all work**.

    a. Identify the following:

    n = **12**   p = **0.7**   q = **0.3**

    b. Find the probability that when 12 college students are randomly selected, 10 or more had student loan debt.

    $$P(10) =\ _{12}C_{10} \cdot 0.7^{10} \cdot 0.3^2 \approx 0.1678$$
    $$P(11) =\ _{12}C_{11} \cdot 0.7^{11} \cdot 0.3^1 \approx 0.0712$$
    $$P(12) =\ _{12}C_{12} \cdot 0.7^{12} \cdot 0.3^0 \approx 0.0138$$
    $$P(x \geq 10) = 0.1678 + 0.0712 + 0.0138 = 0.2528$$

    c. Find the probability that when 12 college students are randomly selected, less than 10 had student loan debt.

    $$P(x < 10) = 1 - P(x \geq 10) = 0.7472$$

(EXTRA CREDIT)

1. 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 fail the test?

$$n = 10, p = 0.5, q = 0.5, r = 7$$

$$P(7) = {}_{10}C_7 \cdot 0.5^7 \cdot 0.5^3 \approx 0.1172$$

$$P(8) = {}_{10}C_8 \cdot 0.5^8 \cdot 0.5^2 \approx 0.0439$$

$$P(9) = {}_{10}C_9 \cdot 0.5^9 \cdot 0.5^1 \approx 0.0098$$

$$P(10) = {}_{10}C_{10} \cdot 0.5^{10} \cdot 0.5^0 \approx 0.0010$$

$$P(x \geq 7) = 0.1719$$

$$P(x < 7) = 1 - 0.1719 = 0.8281$$

2. In a research study, 97% of the 3850 Facebook users are adults. Find the mean and standard deviation for this distribution.

$$\mu = np = 3850 \times 0.97 = 3734.5$$

$$\sigma = \sqrt{npq} = \sqrt{3850 *.97 *.03} \approx 10.58$$