Department of Mathematics
University of Notre Dame
Math 10120 – Finite Math.
Spring 2016

Name:_____

Instructors: Bhattacharya/Galvin

Exam 2

March 3, 2016

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May the odds be ever in your favor!

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Multiple Choice

1. (5 pts.) An experiment consists of rolling a 6-sided die twice and recording the outcomes in order. What is the probability that the sum of the numbers is less than or equal to 4?

(a) $\frac{1}{6}$ (b) $\frac{3}{6}$ (c) $\frac{5}{6}$

(d) $\frac{4}{6}$ (e) $\frac{2}{6}$

2. (5 pts.) An experiment has a sample space $S = \{a, b, c\}$ with $P(c) = .4$ and $P(a) = 2P(b)$. Find the probability of the event $E = \{a, c\}$

(a) .7 (b) .6 (c) .8

(d) .5 (e) .4

3. (5 pts.) A fair coin is flipped 10 times and the sequence of heads and tails is recorded. What is the probability of getting at least one head **and** at least one tail?

(a) $\frac{2}{2^{10}}$ (b) $1 - \frac{1}{2^{10}}$ (c) $1 - \frac{2}{2^{10}}$

(d) $C(10,2)\frac{1}{2^{10}}$ (e) $(C(10,1) + C(10,9))\frac{1}{2^{10}}$

4. (5 pts.) In a class of 100 students in Mouth Bend high school, 60 students like English Literature, 40 students like Mathematics and 30 students like both. If a random student is chosen from the class, what is the probability that he dislikes both English Literature and Mathematics?

(a) $\frac{3}{10}$ (b) $\frac{0}{10}$ (c) $\frac{2}{10}$

(d) $\frac{1}{10}$ (e) $\frac{4}{10}$

5. (5 pts.) A modified deck of cards consists of 12 red cards and 8 black cards. An experiment consists of drawing two cards (one at a time) without replacement. What is the probability that exactly one red card is drawn?

(a) $\frac{71}{95}$ (b) $\frac{47}{95}$ (c) $\frac{48}{95}$

(d) $\frac{24}{95}$ (e) $\frac{50}{95}$

6. (5 pts.) When a smartphone is dropped on to concrete, the probability that the screen will crack is .35; the probability that the battery will break is .10; and the probability that both the screen will crack and the battery will break is .055. I drop my phone on to concrete and observe that as a result the screen is cracked. What is the probability that also the battery is damaged? (All options are rounded to three decimal places.)

(a) 0.100 (b) 0.157 (c) 0.250

(d) 0.004 (e) 0.500

7. (5 pts.) A box contains five lightbulbs, of which three are defective and two are good. Bob takes out bulbs one at a time and tests them, stopping as soon as he has found a good bulb. After testing, he does **not** return bulbs to the box. What is the probability that he finds the first good bulb the **third** time he draws and test?

(a) $\frac{13}{20}$ (b) $\frac{1}{10}$ (c) $\frac{2}{5}$

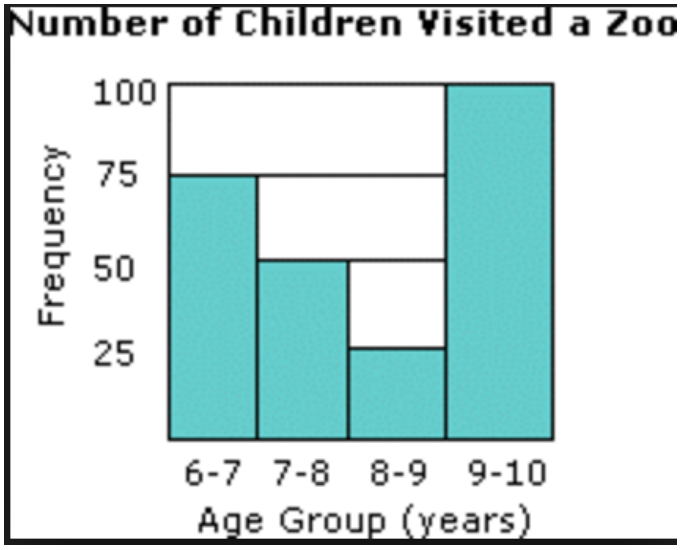
(d) $\frac{3}{10}$ (e) $\frac{1}{5}$

8. (5 pts.) Jen and Kate work on a mathematics problem independently. The probability that Jen solves the problem correctly is 0.78, and the probability that Kate solves the problem correctly is 0.67. What is the probability that they both solve the problem correctly?

(a) 0.4774 (b) 0.1474 (c) 0.2574

(d) 0.5226 (e) 0.4048

9. (5 pts.) A survey was taken of 250 children taking part in a zoo program, in an effort to find the mean age of participants. The data was recorded in the histogram shown below. Based on this data, estimate the mean age of the participants based on the method we discussed in class.



(a) 9.5 (b) 7.6 (c) 8.6

(d) 8 (e) 8.1

10. (5 pts.) A restaurant owner observed that over the course of an evening, three customers each left \$10 tips, five customers each left \$5 tips, one customer left a \$15 tip, and one costumer left no tip. What was the median tip left by a customer that evening?

(a) \$7 (b) \$3 (c) \$7.50

(d) \$5 (e) \$10

Partial Credit

You must show **all of your work** on the partial credit problems to receive full credit! Make sure that your answer is **clearly** indicated. You're more likely to get partial credit for a wrong answer if you explain your reasoning.

11. (10 pts.) An experiment consists of picking one ball at a time without replacement from a bag consisting of 4 red balls and 6 blue balls. You stop picking balls from the bag once you get two balls of the same color.

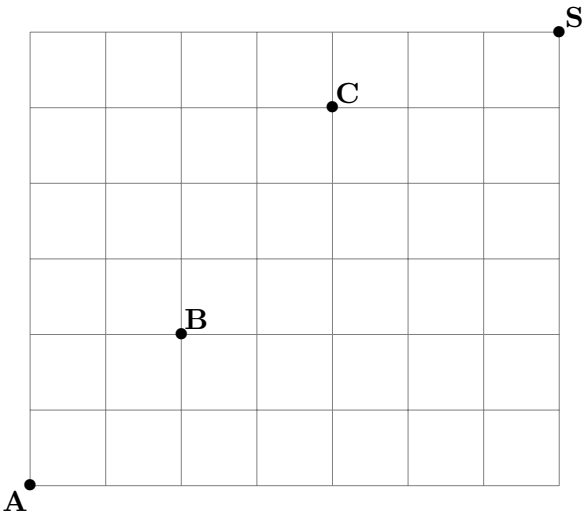
(a) Draw a tree diagram to represent the experiment. All branches of the diagram should be labeled with probabilities.

(b) Find the probability of drawing 2 red balls (this includes the possibility of drawing two red balls and a blue ball, as well as just drawing two red balls).

(c) Find the probability of drawing exactly 2 balls.

12. (10 pts.) For this problem you do not need to simplify your answers; you may leave in terms of $P(n,k)$, $C(n,k)$ or $n!$, etc., if you so choose.

The following is part of the city map of Anytown, USA.

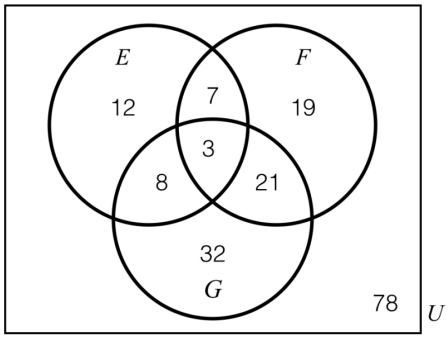


Toby wants to go from Airport **A** to the shopping mall **S** (only traveling east or north). He selects a random path. **B** is Bob's house and **C** is Carl's house.

(a) What is the probability that Toby passes by Bob's house on his way to shopping mall?

(b) What is the probability that Toby does not pass either Bob's house or Carl's house?

13. (10 pts.) This Venn diagram shows the number of students, in a class of 180, that belong to the theatre club (event E), play intramural quidditch (event F) and work as art gallery docents (event G).



A student is chosen at random from the class.

(a) Compute $\mathbf{P}(G)$

(b) Compute $\mathbf{P}(G|F)$

(c) Compute the probability that the student takes part in all three activities, given the information that she takes part in at least two of them.

14. (10 pts.) 10% of the population have a certain condition, X. There is a test for X. When someone has condition X, the test correctly detects this 70% of the time. When someone doesn't have condition X, the test correctly detects this 80% of the time.

(a) A person is chosen at random from the population, and takes the test for condition X. Using a tree diagram, calculate each of the following probabilities:

$$\mathbf{P}(\text{person has condition } X \textbf{ and } \text{tests positive for it}) =$$

$$\mathbf{P}(\text{has condition } X \textbf{ and } \text{tests negative (false negative)}) =$$

$$\mathbf{P}(\text{doesn't have condition } X \textbf{ and } \text{tests positive (false positive)}) =$$

$$\mathbf{P}(\text{doesn't have condition } X \textbf{ and } \text{tests negative}) =$$

(b) Given the information that the randomly selected person tests positive, what is probability they have condition X?

15. (10 pts.) A sample of 12 students were asked how many times they visited Waddicks over the course of the last seven days. The answers they gave are as follows:

$$2,\ 4,\ 4,\ 3,\ 0,\ 3,\ 4,\ 0,\ 2,\ 1,\ 0,\ 4$$

(a) What is the relative frequency of the outcome "3" in this data set?

(b) What is the sample mean of this data set?

(c) What is the sample median of this data set?

(d) What is the sample mode of this data set?

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