Chapter 7 Probability Review

<u>Formulas on Exam</u>

$$P(\overline{A}) = 1 - P(A) \qquad\qquad P(AorB) = P(A) + P(B) - P(AandB)$$

$$P(A/B) = \frac{P(AandB)}{P(B)} \qquad\qquad P(AandB) = P(A) \times P(B/A)$$

$$P(x) = {}_nC_x\, p^x q^{n-x} \qquad (q = 1 - p)$$

<u>Simplified Definitions</u>

Mutually Exclusive: No overlapping sample space.

Not Mutually Exclusive: Overlapping sample space.

Independent Events: The outcome of a first event does not affect the probability of a second event.

Dependant Events: The outcome of a first event affects the probability of a second event.

<u>Using your calculator</u>

For binomial probability only!

Exactly " x " successes: $binompdf(n, p, x)$

At most " x " successes: $binomcdf(n, p, x)$

$n =$ number of trials $p =$ probability of success

Review Questions

1. A die was rolled 120 times and a "six" came up 24 times. What is the experimental probability of getting a six?

2. A card is removed from a standard deck of cards. What is the probability that the card is a face card or a spade?

3. A pair of dice is rolled. What is the probability of rolling doubles or a sum of seven?

4. A card is removed from a standard deck of cards. What is the probability that the card is a red card and a queen?

5. Given $P(A) = .7$, $P(B) = .45$ and $P(\overline{A} \, or \, \overline{B}) = .10$, determine $P(A \, and \, B)$.

6. Fifty-four percent of people trying to lose weight are on low carbohydrate diets and thirty-eight percent of people trying to lose weight are exercising. If thirty-nine percent of people trying to lose weight are doing neither, determine the percent of:

   a) People trying on low carbohydrate diets and exercising.

   b) People trying to lose weight by only a low carbohydrate diet.

   c) People trying to lose weight by only being on a low carbohydrate diet or only exercising.

7. Classify the following events as being mutually exclusive, not mutually exclusive, independent or dependant.

   a) Drawing a red card or a spade.

   b) Drawing two aces from a deck of cards without replacement.

   c) Flipping a coin twice and getting heads both times.

   d) Drawing a face card or a jack.

8. The results of a recent exam had fifteen percent of students earning at least a "B", sixty-five percent with at least a "C-", and forty-five percent with less than a "C". What percent of the students received a "C" or a "C+"?

9. A spinner has the numbers 1, 2 and 3. What is the probability that the sum of two spins is an odd number?
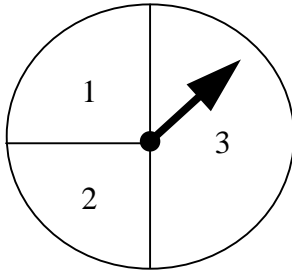
10. Tina and Brenda are two members of the Terry Fox Tennis team. Tina wins 70% of her matches and Brenda wins 55% of her matches. Assuming independence, determine the probability that Brenda wins her next match and Tina does not.

11. Two cards are drawn from a standard deck of cards without replacement. Determine the probability that:

    a) Both cards are face cards.

    b) The second card is an ace.

    c) At least one card is a diamond.

12. A single ball is drawn from box 1 then a single ball is drawn from box 2. Determine the probability that:
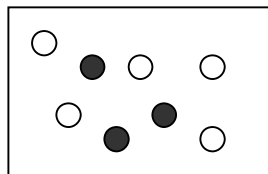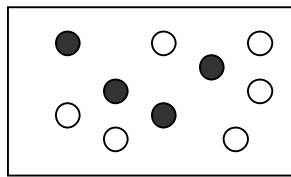

Box 1   Box 2
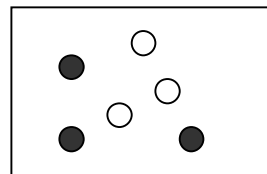
    a) Both balls are white

    b) Only the second ball is white.

    c) At most one ball is white.

13. Using the boxes from question 12, a single ball is drawn from box 1. If the ball is white, a second ball is drawn from box 2. If the first ball drawn is not white, a second ball is drawn from box 1. Determine the probability that:

    a)   Both balls are white.

    b)   The second ball is white.

14. A student takes a multiple choice test. All of the questions have a choice of A, B, C or D. There is only one correct answer for each question. The student guessed on two of the questions. Given that at least one of the guesses is correct, what is the probability that both guesses are correct?

15. Forty-three percent of students in a classroom are boys and the rest are girls. Sixty percent of the boys have their driver's license. Fifty-five percent of the girls have their driver's license. Determine the probability that a randomly selected student does not have a driver's license.

16. A single die is rolled. If a 1 or 6 is rolled, a ball is removed from box 1. If a 2-5 is rolled, a ball is removed from box 2.

Box 1   Box 2
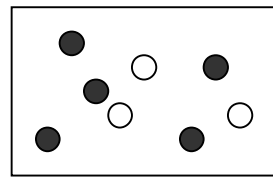
    a)   Determine the probability that the ball is white.

    b)   Given that the ball is white, determine the probability that the ball came from box 1.

17. In a class of thirty students, eight are A or B students and the rest are C+ or less students. A or B students score over 600 on SAT math tests 80% of the time. C+ or less students score under 600 on the same test 75% of the time.

    a)   Determine the probability of a student in the class scoring under 600.

    b)   Given that a student scored under 600, determine the probability that it was an A or B student.

18. A sporting goods store has a bin of balls for sale. There are six soccer balls, ten footballs and three volley balls. The store sold six of the balls by the end of the sale. Determine the probability that:

   a)   The store sold exactly three soccer balls, two footballs and one volleyball.

   b)   The store sold at least four soccer balls.

19. Five cards are dealt from a standard deck of cards. Determine the probability that:

   a)   There are exactly three hearts.

   b)   There are two face cards, two aces and another card that is not a face card or ace.

   c)   There are at most four face cards.

20. Fred and Colleen are members of a class of thirty students. The class has a election for president, vice-president. Determine the probability of Fred being elected president and Colleen being elected vice-president.

21. Jim goes to a car dealership to buy a new pickup truck. The dealership has a special that allows customers to select four options for free. The options include: pin striping, winter floor mats, tinted windows, driver vanity mirror, sound system upgrade, seat warmers, wheel locks and a roof rack. Determine the probability that Jim selects tinted windows and seat warmers as two of his options and does not select pin striping as one of his other two options.

22. A fair coin is tossed ten times determine the probability of getting:

   a)   Exactly four heads.

   b)   At least two heads.

   c)   Two to four head inclusive.

   d)   At most eight heads.

   Express your answer with $_nC_r$ notation.

23. A recent survey of British Columbia high school grade 12 students revealed that 65% of students did not take Math 12. Determine the probability that in a group of 100 randomly selected grade 12 students:

   a) Exactly 31 took Math 12.

   b) At least 31 took Math 12.

   c) Between 31 and 45 inclusive took Math 12.

   Use the binomial probability functions in your calculators for this question. Include the function and the values used to determine your answer.

24. A certain game involves rolling a pair of dice. If doubles, a sum of eleven or a sum of seven is rolled, a person would win the game. A person plays the game six times. Given that the person won at least four times, what is the probability that the person won exactly five times?

   Use the binomial probability functions in your calculators for this question. Include the function and the values used to determine your answer.

25. The chance of precipitation being over 30mm on any given month in B.C. is 77%. Determine the probability that their will be at least 6 months in any given year with over 30mm of rain.

26. The Canucks are playing a best of seven series against the Sharks. The probability of the Canucks defeating the Sharks on any given game is 0.55. Determine the probability of the Canucks winning the series in at most six games.

Solutions

1. $\dfrac{1}{5} = 0.2$ 2. $\dfrac{11}{26} = 0.42$ 3. $\dfrac{1}{3} = 0.33$ 4. $\dfrac{1}{26} = 0.038$

5. 0.25   6a. 31%   6b. 23%   6c. 30%

7. a) Mutually Exclusive   b) Dependant   c) Independent

   d) Not Mutually Exclusive

8. 40%   9. $\dfrac{3}{8} = 0.375$ 10. 0.165

11. a) $\dfrac{11}{221} = 0.050$ b) $\dfrac{1}{13} = 0.077$ c) $\dfrac{15}{34} = 0.441$

12.   a) $\dfrac{5}{16} = 0.313$ b) $\dfrac{3}{16} = 0.188$ c) $\dfrac{11}{16} = 0.688$

13.   a) $\dfrac{5}{16} = 0.313$ b) $\dfrac{65}{112} = 0.58$

14. $\dfrac{1}{7} = 0.143$ 15. 0.429

16.   a) $\dfrac{9}{20} = 0.45$ b) $\dfrac{4}{9} = 0.44$

17.   a) 0.603 b) 0.088

18.   a) 0.0995 b) 0.046

19.   a) 0.082 b) 0.005 c) 0.9997

20. $\dfrac{1}{870} = 0.001$ 21. $\dfrac{1}{7} = 0.143$

22.   a) $_{10}C_4 (0.5)^{10} = 0.205$ b) $1 - \left(_{10}C_0 (0.5)^{10} + _{10}C_1 (0.5)^{10} \right) = 0.989$

       c) $_{10}C_2 (0.5)^{10} + _{10}C_3 (0.5)^{10} + _{10}C_4 (0.5)^{10} = 0.366$

       d) $1 - \left(_{10}C_9 (0.5)^{10} + _{10}C_{10} (0.5)^{10} \right) = 0.989$

23.   a) $binompdf(100, 0.35, 31) = 0.06$ b) $1 - binomcdf(100, 0.35, 30) = 0.827$

       c) $binomcdf(100, 0.35, 45) - binomcdf(100, 0.35, 30) = 0.812$

24. $\dfrac{binompdf(6, 7/18, 5)}{1 - binomcdf(6, 7/18, 3)} = 0.1986$

25. 0.991 26. 0.442