AFM Probability Review

Name: Key

1) Given a standard deck of 52 cards, 3 cards are dealt without replacement. Using this situation, answer the questions below.

a) What is the probability that all three cards are queens? $\frac{4}{52} \cdot \frac{3}{51} \cdot \frac{2}{50} = \frac{1}{5525}$

b) Let the first card be the queen of hearts and the second card be the queen of diamonds. Is the probability of drawing the two cards independent? Explain.

No, because the outcomes change

c) If the first card is a queen, what is the probability that the second card will not be a queen?

$\frac{\#\text{cards left} \to 48}{\text{total} \to 51} = \frac{16}{17}$

d) If the first two cards are queens, what is the probability that you will be dealt three queens?

$\frac{\#\text{Queens left} \to 2}{\text{total} \to 50} = \frac{1}{25}$

e) If two of the three cards are queens, what is the probability that the other card is not a queen?

$\frac{\#\text{cards left} \to 48}{\text{total} \to 50} = \frac{24}{25}$

2) Given a standard deck of 52 cards, 3 cards are dealt. If each card is replaced in the deck (and the deck is well shuffled) after being dealt answer the questions below.

a) What is the probability that all three cards are queens? $\frac{4}{52} \cdot \frac{4}{52} \cdot \frac{4}{52} = \frac{1}{2197}$

b) Let the first card be the queen of hearts and the second card be the queen of diamonds. Is the probability of drawing the two cards independent? Explain.

yes, outcomes do not change

c) If the first card is a queen, what is the probability that the second card will not be a queen?

$48/52 = 12/13$

d) If the first two cards are queens, what is the probability that you will be dealt three queens?

$4/52 = 1/13$

e) If two of the three cards are queens, what is the probability that the other card is not a queen?

$48/52 = 12/13$ 10 total

3) A bag contains 3 red marbles, 5 green marbles, and 2 blue marbles. Two consecutive draws are made from the bag (without replacement of the first draw). Find the probability of each event:

a) p(red, blue) = $1/15$ $3/10 \cdot 2/9 = 6/90 = 1/15$

b) p(blue, blue) = $1/45$ $2/10 \cdot 1/9 = 2/90 = 1/45$

c) p(both draws were neither red or green) = $1/45$ $2/10 \cdot 1/9 = 2/90 = 1/45$

d) p(red, not red) = $7/30$ P(Blue) $3/10 \cdot 7/9 = 21/10 = 7/30$

10 total

4) A bag contains 3 red marbles, 5 green marbles, and 2 blue marbles. Two consecutive draws are made from the bag (with replacement). Find the probability of each event:

a) p(red, blue) = 3/50 $3/10 \cdot 2/10 = 6/100 = 3/50$

b) p(blue, blue) = 1/25 $2/10 \cdot 2/10 = 4/100 = 1/25$

c) p(both draws were neither red or green) = 1/25 $2/10 \cdot 2/10 = 4/100 = 1/25$

d) p(red, not red) = 21/100 P(B) $3/10 \cdot 7/10 = 21/100$

5) You are dealt two cards (without replacement) from a standard deck of 52 cards.

a) What is the probability that the first card you are dealt is an ace? $4/52 = 1/13$

b) If the first card was an ace, what is the probability that the second card you are dealt is a Jack?

4/51

c) What is the probability that you are dealt an Ace and a Jack in any order?

P(A and J) or P(J and A) $4/52 \cdot 4/51 + 4/52 \cdot 4/51 = 8/663$

d) If an ace is worth 11 points and a 10, Jack, Queen, and King are worth 10 points each, what is the probability that you will obtain 21 points with two cards?

P(A & 10) or P(A & J) or P(A & Q) or P(A & K) → then all these the other way!

$2\left(4/52 \cdot 4/51 + 4/52 \cdot 4/51 + 4/52 \cdot 4/51 + 4/52 \cdot 4/51\right) = 32/663$

6) You survey your classmates to determine their favorite flavor of ice cream. You think males may prefer vanilla and females may prefer chocolate, so you tally their responses separately. You found the following results:

	Vanilla	Chocolate	Other
Males	23	10	10
Females	8	17	9

43
34
> 77 total

a) What is the probability that a randomly selected student prefers chocolate?

27/77

b) What is the probability that a randomly selected student is a female and prefers chocolate?

17/77

c) If the student chosen is a female, what is the probability that she prefers chocolate?

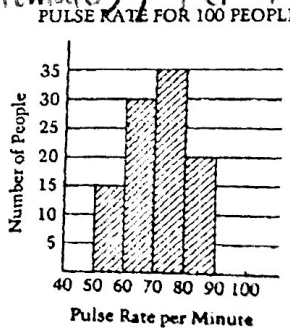
17/34 = 1/2

d) Are the events "female" and "prefers chocolate" independent or dependent? Explain.

dependent P(prefers choc | female) ≠ P(prefer choc)

7) The pulse rate for a group of 100 people is shown in the graph. What is the average pulse rate per minute for these 100 people? (Note: Use the midpoint of each interval to represent the pulse rate for the entire interval. For example, 55 would be used for the pulse rate of the 15 people in the 50-60 group.)

71



8) Matthew shoots 6 free throws. Let x = # shots that Matthew makes. Let p(x) represent the probability of making that many shots. Use the table below to answer the following.

X	0	1	2	3	4	5	6
P(x)	*0.0*	*0.01*	*0.06*	*0.19*	*0.32*	*0.30*	*0.12*

a) What is the probability that Matthew makes 3 free throws?

0.19

b) What is the probability that Matthew makes at least 3 free throws?

0.93

c) What is the probability that Matthew misses at least 3 free throws?

0.26

d) How many free throws do you <u>expect</u> Matthew to make? Expected value problem!

4.2 ⟹ 4 shots

9) If you roll a die, the probability that you land on a "one" is 1/6. If you roll the same die <u>twice</u>, what is the probability that:

a) You land on two "ones" in a row? 1/36

b) You never land on a "one"? 25/36

c) You land on at least one "one"? 11/36

12 total

10) A sack contains 7 blue, 3 red, and 2 green marbles. If you draw a marble, <u>replace it</u>, and then draw another marble, what is the probability that:

a) p(red, green) = 1/24 $3/12 \cdot 3/12 = 6/144 = 1/24$

b) p(red, red) = 1/16 $3/12 \cdot 3/12 = 9/144 = 1/16$

c) p(at least one blue) = 119/144

d) p(red or blue) = 25/36

e) p(not blue) = 25/144 $5/12 \cdot 5/12 = 25/144$

f) Which is more likely to occur and why: drawing the marble colors "red, blue, blue, red" or the marble colors "blue, blue, green, red, blue, blue"?

More likely to get R, B, B, R

Probability is larger.

11) Given the probability distribution, calculate the expected value. Show your process!

x	0	1	2	3
P(x)	.3	.2	.4	.1

1.3

12) Suppose the probability of winning a game is 1/100. In order to play the game, you must pay $5. If you win, you will receive $200.

Outcome	P(outcome)	Payoff
Win	1/100	$200
Lose	99/100	$0

a) Fill in the probability distribution for the table shown.

b) How much money do you expect to win each time you play the game (do not take into account the $5.00). $2

c) What is your "net gain/loss" each time that you play?

loss of $3 since you pay $5 to play

d) If you played the game 50 times, how much money would you win/lose?

win $100, still a loss though since you paid $250 to play 50 times

13) A bag contains 6 yellow marbles, 3 blue marbles and 8 red marbles. If you randomly select 6 marbles from the bag (without replacement), what is the probability that you select 3 yellow, 1 blue, and 2 red marbles in this order?

17 total

$\frac{28}{12870} = \frac{1}{459.2}$

$\frac{{}_6C_3 = 20}{{}_{17}C_6} + \frac{{}_3C_1 = 3}{{}_{17}C_3} + \frac{{}_8C_2 = 28}{{}_{13}C_2}$

14) A fair coin is to be tossed three times. What is the probability that 2 heads and 1 tail in any order will come up?

HHH THH ✓
✓HHT TTH
HTT HTH ✓
TTT THT

3/8

$\frac{5}{30}$ + $\frac{3}{36}$ + $\frac{14}{39}$

15) Three dice are rolled. What is the probability of getting a sum of at least 6? 6·6·6 = 216

* Look up 3 dice sample space 203/216

16) The American Diabetes Association estimates that 5.9% of Americans have diabetes. Suppose that a medical lab has developed a simple diagnostic test for diabetes that is 98% accurate for people who have the disease and 95% accurate for people who do not have it. If the medical lab gives the test to a randomly selected person, answer the following.

a) What is the probability that the person has diabetes given a positive test?

55.1%

b) What is the probability that the test is positive given the person has diabetes?

98%

c) What is the probability that the diagnosis is correct?

0.059·0.98 + 0.941·0.95 = 0.952