Betsy Rosalen HW 2

HW 2

Question 1

There are 540 identical plastic chips numbered 1 through 540 in a box. What is the probability of reaching into the box and randomly drawing the chip numbered 505? Express your answer as a fraction or a decimal number rounded to four decimal places.

$$P(505) = \frac{1}{540}$$

Question 2

Write out the sample space for the given experiment. Separate your answers using commas.

When deciding what you want to put into a salad for dinner at a restaurant, you will choose one of the following extra toppings: asparagus, cheese. Also, you will add one of following meats: eggs, turkey. Lastly, you will decide on one of the following dressings: French, vinaigrette. (Note: Use the following letters to indicate each choice: A for asparagus, C for cheese, E for eggs, T for turkey, F for French, and V for vinaigrette.)

S = AEF, AEV, ATF, ATV, CEF, CEV, CTF, CTV

Question 3

A card is drawn from a standard deck of 52 playing cards. What is the probability that the card will be a heart and not a face card? Write your answer as a fraction or a decimal number rounded to four decimal places.

$$P(\text{heart and not a face card}) = \frac{10}{52} \text{ or reduced to } \frac{5}{26}$$

Question 4

A standard pair of six-sided dice is rolled. What is the probability of rolling a sum less than 6? Write your answer as a fraction or a decimal number rounded to four decimal places.

$$P(sum < 6) = \frac{10}{36} \text{ or } \frac{5}{18}$$

Question 5

A pizza delivery company classifies its customers by gender and location of residence. The research department has gathered data from a random sample of 2001 customers. The data is summarized in the table below.

Gender and Residence of Customers		
—	Males	Females
Apartment	233	208
Dorm	159	138
With Parent(s)	102	280
Sorority/Fraternity House	220	265
Other	250	146

What is the probability that a customer is male? Write your answer as a fraction or a decimal number rounded to four decimal places.

$$P(\text{Male}) = \frac{233 + 159 + 102 + 220 + 250}{2001}$$

$$P(\text{Male}) = \frac{964}{2001}$$

Question 6

Three cards are drawn with replacement from a standard deck. What is the probability that the first card will be a club, the second card will be a black card, and the third card will be a face card? Write your answer as a fraction or a decimal number rounded to four decimal places.

$$P(\text{Club}) \cdot P(\text{Black}) \cdot P(\text{Face}) = \frac{4}{52} \cdot \frac{26}{52} \cdot \frac{12}{52} = \frac{3}{338}$$

Question 7

Two cards are drawn without replacement from a standard deck of 52 playing cards.

What is the probability of choosing a spade for the second card drawn, if the first card, drawn without replacement, was a heart? Write your answer as a fraction or a decimal number rounded to four decimal places.

$$P(\text{Spade} \mid \text{Heart}) = \frac{13}{51}$$

Question 8

Two cards are drawn without replacement from a standard deck of 52 playing cards.

What is the probability of choosing a heart and then, without replacement, a red card? Write your answer as a fraction or a decimal number rounded to four decimal places.

$$P(\text{Heart}) \cdot P(\text{Red} \mid \text{Heart}) = \frac{13}{52} \cdot \frac{25}{51} = \frac{25}{204}$$

Question 9

There are 85 students in a basic math class. The instructor must choose two students at random.

Students in a Basic Math Class		
—	Males	Females
Freshmen	12	12
Sophomores	19	15
Juniors	12	4
Seniors	7	4

What is the probability that a junior female and then a freshmen male are chosen at random? Write your answer as a fraction or a decimal number rounded to four decimal places.

$$P(\text{JF}) \cdot P(\text{FM} \mid \text{JF}) = \frac{4}{85} \cdot \frac{12}{84} = \frac{4}{595}$$

Question 10

Out of 300 applicants for a job, 141 are male and 52 are male and have a graduate degree.

Step 1. What is the probability that a randomly chosen applicant has a graduate degree, given that they are male? Enter your answer as a fraction or a decimal rounded to four decimal places.

$$P(\text{Graduate Degree} \mid \text{Male}) = \frac{52}{141}$$

Step 2. If 102 of the applicants have graduate degrees, what is the probability that a randomly chosen applicant is male, given that the applicant has a graduate degree? Enter your answer as a fraction or a decimal rounded to four decimal places.

$$P(\text{Male} \mid \text{Graduate Degree}) = \frac{52}{102}$$

Question 11

A value meal package at Ron's Subs consists of a drink, a sandwich, and a bag of chips. There are 6 types of drinks to choose from, 5 types of sandwiches, and 3 types of chips. How many different value meal packages are possible?

$6 \cdot 5 \cdot 3 =$ 90 different value meal packages are possible.

Question 12

A doctor visits her patients during morning rounds. In how many ways can the doctor visit 5 patients during the morning rounds?

```
factorial(5)
```

```
## [1] 120
```

The doctor can visit her patients in 120 different ways during her morning rounds.

Question 13

A coordinator will select 5 songs from a list of 8 songs to compose an event's musical entertainment lineup. How many different lineups are possible?

```
fp=function(N,n){factorial(N)/factorial(N-n)}
fp(8,5)
```

```
## [1] 6720
```

6720 different lineups are possible assuming that the order of songs matters.

Question 14

A person rolls a standard six-sided die 9 times. In how many ways can he get 3 fours, 5 sixes and 1 two?

```
fc=function(N,n){factorial(N)/(factorial(n)*factorial(N-n))}
fours <- fc(9,3)
fours
```

```
## [1] 84
```

```
sixes <- fc(6,5)
sixes
```

```
## [1] 6
```

```
fours * sixes
```

```
## [1] 504
```

There are 504 ways to get 3 fours, 5 sixes and 1 two if you roll a die 9 times.

Question 15

How many ways can Rudy choose 6 pizza toppings from a menu of 14 toppings if each topping can only be chosen once?

```
fc(14,6)
```

```
## [1] 3003
```

There are 3003 different combinations of 6 toppings that Rudy can order for his pizza.

Question 16

3 cards are drawn from a standard deck of 52 playing cards. How many different 3-card hands are possible if the drawing is done without replacement?

```
fc(52,3)
```

```
## [1] 22100
```

There are 22,100 different 3 card hands possible from a 52 card deck.

Question 17

You are ordering a new home theater system that consists of a TV, surround sound system, and DVD player. You can choose from 12 different TVs, 9 types of surround sound systems, and 5 types of DVD players. How many different home theater systems can you build?

$$12 \cdot 9 \cdot 5 = \text{ 540 different home theater systems are possible.}$$

Question 18

You need to have a password with 5 letters followed by 3 odd digits between 0 - 9 inclusively. If the characters and digits cannot be used more than once, how many choices do you have for your password?

```
A = fp(52,5)  # Assuming case sensitive so there are 26 lowercase and 26 uppercase characters possible
B = fp(10,3)
A*B
```

```
## [1] 224550144000
```

```
a = fp(26,5)  # Assuming NOT case sensitive so there are 26 letters
b = fp(10,3)
a*b
```

```
## [1] 5683392000
```

There are 224,550,144,000 possible passswords assuming that the password is case sensitive and 5,683,392,000 if it is not case sensitive.

Question 19

Evaluate the following expression.

$$_9P_4$$

```
fp(9,4)
```

```
## [1] 3024
```

Question 20

Evaluate the following expression.

$$_{11}C_8$$

```
fc(11,8)
```

```
## [1] 165
```

Question 21

Evaluate the following expression.

$$\frac{_{12}P_8}{_{12}C_4}$$

```
N = fp(12,8)
D = fc(12,4)
N/D
```

```
## [1] 40320
```

Question 22

The newly elected president needs to decide the remaining 7 spots available in the cabinet he/she is appointing. If there are 13 eligible candidates for these positions (where rank matters), how many different ways can the members of the cabinet be appointed?

```
fp(13,7)
```

```
## [1] 8648640
```

There are 8,648,640 different ways the members of the cabinet can be appointed.

Question 23

In how many ways can the letters in the word 'Population' be arranged?

Assuming the uppercase P and lowercase p are the same...

```
p <- fc(10,2)
p
```

```
## [1] 45
```

```
o <- fc(8,2)
o
```

```
## [1] 28
```

```
rest <-fp(6,6)
rest
```

```
## [1] 720
```

```
p*o*rest
```

```
## [1] 907200
```

There are 907,200 ways that you can arrange the letters in the word population if your word is in all upper or lower case or not case-sensitive

If the letters ARE case-sensitive and the two P's are different...

```
o <- fc(10,2)
o
```

```
## [1] 45
```

```
rest <-fp(8,8)
rest
```

```
## [1] 40320
```

```
o*rest
```

```
## [1] 1814400
```

There are 1,814,400 ways to arrange the letters if you treat the upper and lower case P's as two different letters.

Question 24

Consider the following data:

x	5	6	7	8	9
p(x)	0.1	0.2	0.3	0.2	0.2

Step 1. Find the expected value $E(X)$. Round your answer to one decimal place.

```
mu <- 5*0.1 + 6*0.2 + 7*0.3 + 8*0.2 + 9*0.2
mu
```

```
## [1] 7.2
```

$$E(X) = 7.2$$

Step 2. Find the variance. Round your answer to one decimal place.

```
v = round(((5-mu)^2)*0.1 + ((6-mu)^2)*0.2 + ((7-mu)^2)*0.3 + ((8-mu)^2)*0.2 + ((9-mu)^2)*0.2,1)
v
```

```
## [1] 1.6
```

$$V(X) = 1.6$$

Step 3. Find the standard deviation. Round your answer to one decimal place.

```
sd <- round(sqrt(v),1)
sd
```

```
## [1] 1.3
```

$$\sigma = 1.3$$

Step 4. Find the value of $P(X \S 9)$. Round your answer to one decimal place.

Step 5. Find the value of $P(X £ 7)$. Round your answer to one decimal place.

Question 25

Suppose a basketball player has made 188 out of 376 free throws. If the player makes the next 3 free throws, I will pay you $23. Otherwise you pay me $4.

Step 1. Find the expected value of the proposition. Round your answer to two decimal places.

```
x = 188/376
x
```

```
## [1] 0.5
```

```
P = x^3
P
```

```
## [1] 0.125
```

```
EV = P*23 + (1-P)*-4
round(EV, 2)
```

```
## [1] -0.62
```

$$\text{Expected Value} = -\$0.62$$

Step 2. If you played this game 994 times how much would you expect to win or lose? (Losses must be entered as negative.)

```
994 * EV
```

```
## [1] -621.25
```

I'd expect to lose -$621.25 if I played the game 994 times.

Question 26

Flip a coin 11 times. If you get 8 tails or less, I will pay you $1. Otherwise you pay me $7.

Step 1. Find the expected value of the proposition. Round your answer to two decimal places.

```
P = pbinom(8,11,.5)
P
```

```
## [1] 0.9672852
```

```
EV = round(P*1 + (1-P)*-7, 2)
EV
```

```
## [1] 0.74
```

Expected Value = $0.74

Step 2. If you played this game 615 times how much would you expect to win or lose? (Losses must be entered as negative.)

```
615 * EV
```

```
## [1] 455.1
```

I'd expect to win $455.10 if I played the game 615 times.

Question 27

If you draw two clubs on two consecutive draws from a standard deck of cards you win $583. Otherwise you pay me $35. (Cards drawn without replacement.)

Step 1. Find the expected value of the proposition. Round your answer to two decimal places.

```
P = 13/52 * 12/51
P
```

```
## [1] 0.05882353
```

```
EV = round(P*583 + (1-P)*-35, 2)
EV
```

```
## [1] 1.35
```

Expected Value = $1.35

Step 2. If you played this game 632 times how much would you expect to win or lose? (Losses must be entered as negative.)

```
632 * EV
```

```
## [1] 853.2
```

I'd expect to win $853.20 if I played the game 632 times.

Question 28

A quality control inspector has drawn a sample of 10 light bulbs from a recent production lot. If the number of defective bulbs is 2 or less, the lot passes inspection. Suppose 30% of the bulbs in the lot are defective. What is the probability that the lot will pass inspection? (Round your answer to 3 decimal places)

Assuming that the sample is less than 1/20th of the production lot

```
round(ppois(2,3),3)
```

```
## [1] 0.423
```

Question 29

A quality control inspector has drawn a sample of 5 light bulbs from a recent production lot. Suppose that 30% of the bulbs in the lot are defective. What is the expected value of the number of defective bulbs in the sample? Do not round your answer.

1.5 out of a sample of 5 light bulbs would be expected to be deffective.

Question 30

The auto parts department of an automotive dealership sends out a mean of 5.5 special orders daily. What is the probability that, for any day, the number of special orders sent out will be more than 5? (Round your answer to 4 decimal places)

```
round(1 - ppois(5,5.5),4)
```

```
## [1] 0.4711
```

Question 31

At the Fidelity Credit Union, a mean of 5.7 customers arrive hourly at the drive-through window. What is the probability that, in any hour, more than 4 customers will arrive? (Round your answer to 4 decimal places)

```
round(1 - ppois(4,5.7),4)
```

```
## [1] 0.6728
```

Question 32

The computer that controls a bank's automatic teller machine crashes a mean of 0.4 times per day. What is the probability that, in any 7-day week, the computer will crash no more than 1 time? (Round your answer to 4 decimal places)

```
.4*7
```

```
## [1] 2.8
```

```
round(ppois(1,2.8),4)
```

```
## [1] 0.2311
```

Question 33

A town recently dismissed 8 employees in order to meet their new budget reductions. The town had 6 employees over 50 years of age and 19 under 50. If the dismissed employees were selected at random, what is the probability that more than 1 employee was over 50? Write your answer as a fraction or a decimal number rounded to three decimal places.

```
M = 6/25
P = round(1 - pbinom(1,8,M),3)
P
```

```
## [1] 0.608
```

There is a 0.608 probability that more than one employee was over 50.

Question 34

Unknown to a medical researcher, 10 out of 25 patients have a heart problem that will result in death if they receive the test drug. Eight patients are randomly selected to receive the drug and the rest receive a placebo. What is the probability that less than 7 patients will die? Write your answer as a fraction or a decimal number rounded to three decimal places.

```
M = 10/25
P = round(pbinom(6,8,M),3)
P
```

```
## [1] 0.991
```

Wow! Doesn't seem very ethical!