STAT 3011
FALL 2022
Exam 1 (C)
Time Limit: 90 Minutes

Name (Print): _____

Student ID: _____

Instructions:

- Do *not* begin or turn this page until you are instructed.

- Enter all requested information on the top and bottom of this page, and put your initials on the top of every page, in case the pages become separated.

- This exam contains 16 pages (including this cover page and the multiple choice answer sheet). Check to see if any pages are missing. There are 1 multiple choice problem (with ** questions) and ** short answer problems.

- The exam is closed book. You may *not* use your books, or any wireless device on this exam.

- You may use a calculator and one sheet of paper (size A4 or 8.5" by 11") with formulas or other notes on both sides. You may *not* share calculators or notes!

- Show all your work on each problem for full credit except multiple choice problems. The following rules apply:

  - *Organize your work*, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.

  - *Mysterious or unsupported answers will not receive full credit* for short answer problems. A correct answer, unsupported by calculations, explanation, or algebraic work will not receive full credit; an incorrect answer supported by substantially correct calculations and explanation may still receive partial credit.

  - If you need more space, use the back of the pages; clearly indicate when you have done this.

Honesty Statement and Pledge:

I have not given or received any aid or assistance to or from any other student in this course during the exam period. Everything I have written on this exam represents my own work and knowledge. I sign this knowing that infringements on the University's Academic Honest policy may result in failure or expulsion.

Signed By: _____   Date: _____

Problem 1. (40 points) **Multiple Choice**

Choose ONLY ONE answer for each question. Circle your answers to all questions in the answer sheet provided. (NO explanation is needed).

1. (3 points) Which of the following is correct?
   (A) The smaller s^2, the smaller dispersion the distribution has.
   (B) The unit of standard deviation of x is the same as the unit of x
   (C) Median is resistant to outliers whereas mean is not.
   (D) All of the above are correct.

2. (3 points) Based on the histogram below, select the most plausible value for the sample standard deviation (s).

   (A) 0
   (B) -3
   (C) 3
   (D) 10
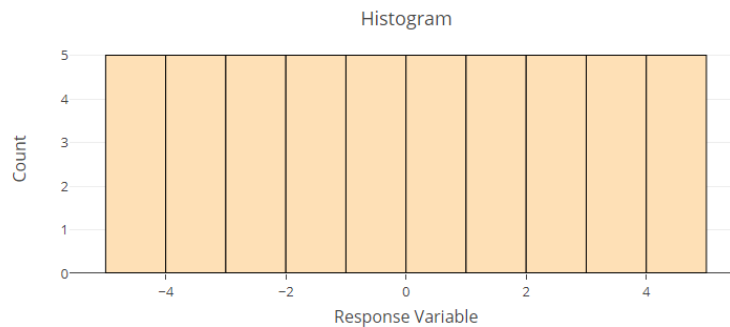
3. (3 points) In 2015, a researcher surveyed how much time (in minutes per day) college students spent on social media while doing school work. Use the following R command and output.

```
> summary(f$FBtime)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   0.00    5.00   30.00   60.07   90.00  480.00
```

   According to this survey, what proportion of college students spend between 30 minutes to 90 minutes on social media while doing school work?
   (A) 25%
   (B) 50%
   (C) 75%
   (D) Unknown.

4. (3 points) Let A and B be independent events. It is known that $P(A) = 0.30$ and $P(A \cap B) = 0.15$. Find the probability $P(A \cup B)$.

   (A) 0.45
   (B) 0.65
   (C) 0.75
   (D) 0.85

5. (3 points) Let C and D be events such that $P(C) = 0.55, P(D) = 0.35$, and $P(C \mid D) = 0.20$. What is the probability that EXACTLY ONE of C or D occurs (but NOT BOTH)?

   (A) 0.40
   (B) 0.60
   (C) 0.66
   (D) 0.76

6. (3 points) The probability distribution of a random variable X is provided in the following table. Select the claim that is incorrect. (Hint: refer to the R command results.)

x	0	1	2	3	4
$P(X = x)$	0.1296	0.3456	0.3456	0.1536	0.0256

```
> dbinom(x = 0, size = 4, prob = 0.4)
[1] 0.1296
> dbinom(x = 1, size = 4, prob = 0.4)
[1] 0.3456
> dbinom(x = 2, size = 4, prob = 0.4)
[1] 0.3456
> dbinom(x = 3, size = 4, prob = 0.4)
[1] 0.1536
> dbinom(x = 4, size = 4, prob = 0.4)
[1] 0.0256
```

   (A) The mean of X equals to 1.6.
   (B) The standard deviation of X equals to 0.980.
   (C) X does not follow a binomial distribution.
   (D) This is a valid probability distribution.

7. (3 points) We have a random variable X with mean 0.5 and standard deviation 0.224. Its density curve is as follows. We know that the density at 0.9 is 0.54 and the probability that X is smaller than 0.1 equals to 0.028. What is the probability that X is smaller than 0.9 and greater than 0.1?

Density Curve of X
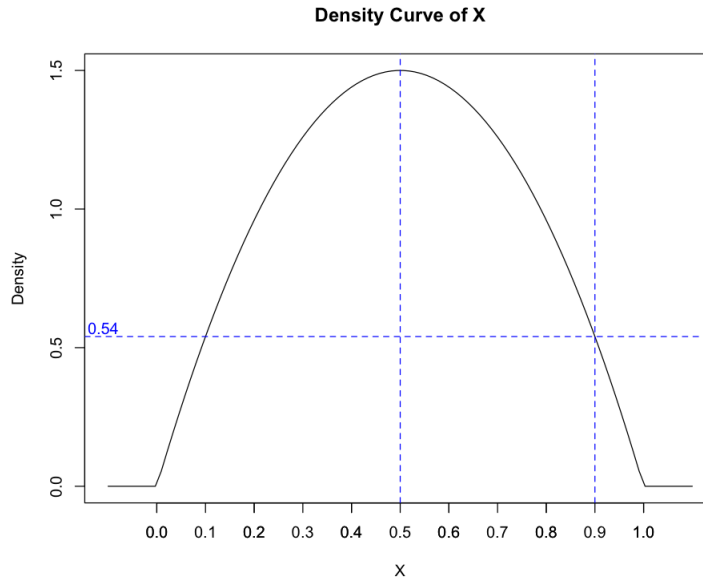
(A) 0.944

(B) 0.54

(C) 0.972

(D) `pnorm(0.9, mean = 0.5, sd = 0.224) - pnorm(0.1, mean = 0.5, sd = 0.224)`

8. (3 points) Suppose we have a random variable $X \sim N(3, 2)$, based on the 68-95-99.7 rule, what is the probability that X is smaller than 9 and greater than or equal to 1?

(A) 0.9735

(B) 0.95

(C) 0.8385

(D) 0.815

9. (3 points) Suppose the height of female undergraduate students follows a normal distribution $N(68, 2)$. What is the correct R command that gives us the probability that a randomly selected female undergraduate student is taller than or equal to 69 inches?

(A) `pnorm(0.5, mean = 68, sd = 2)`

(B) `pnorm(69, mean = 68, sd = 2) + dnorm(69, mean = 68, sd = 2)`

(C) `pnorm(0.5)`

(D) `1 - pnorm(0.5)`

10. (3 points) A college senior scored 95 on the psychology exam and scored 85 on the history exam. The mean score for the psychology exam is 89 with a standard deviation 3. The mean score for the history exam is 80 with a standard deviation 2. Suppose both distributions are normal. Relative to others, which exam did this student do better on?

(A) Psychology

(B) History

(C) Equally well

(D) Cannot decide based on the current information

For Questions 11 and 12: A random sample X_1, X_2, ... X_9 is drawn from a population that follows normal distribution with mean $\mu = 10$ and standard deviation $\sigma = 6$. Let $\overline{X}$ be the sample mean of X_1, X_2, ..., X_9.

11. (3 points) What is the approximate probability that $\overline{X}$ falls within 2 units of the population mean μ. (i.e., $10 - 2 \leq \overline{X} \leq 10 + 2$)? (Hint: Use XX-XX-XX.X Rule)

(A) .997

(B) .95

(C) .68

(D) .13

12. (3 points) If the sample size changes from $n = 9$ to $n = 100$, then how does your answer change in Question 11?

(A) higher

(B) same

(C) lower

(D) cannot tell

13. (4 points) Did you circle multiple choice answers on page 16?

(A) Yes, I did.

(B) I will now.

(C) I will now.

(D) I will now.

Problem 2. (13 points) Be sure to show all work for full credit.

Political scientists have noticed that presidential approval ratings tend to fluctuate with the seasons. To examine this claim, we use data on presidential quarterly approval ratings from 1945 to 1976. The data are displayed in the boxplots below.

Answer the following questions regarding the presidential approval rating data.

1. (3 points) During which quarter does the presidential approval rating seem to be highest? Clearly state your reasoning; state explicitly the statistic you are basing your answer on.

2. (3 points) Give an estimate for IQR for the first quarter approval ratings.

3. (3 points) Below is R commands used to construct the side-by-side

```
> dat<read.csv(file.choose())
> names(dat)
[1] "ratings" "quarters"
> boxplot(_____ ___ _____, xlab="Quarter", ylab="Approval Rating")
```

Fill in the blank that makes a side-by-side boxplot.

4. (2 points) What is the type of this study?

5. (2 points) Identify the explanatory and response variable of this study.

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Problem 3. (15 points) Be sure to show all work for full credit.

2573 Americans were polled about their approval of the President of the U.S. in various quarters. Of the 2573 subjects polled, 355 were polled in the first quarter, 279 in the second quarter, 1558 in the third quarter, and 381 in the fourth quarter. Define the following events:

- Q_1 : the event that a subject was polled in the first quarter.
- Q_2 : the event that a subject was polled in the second quarter.
- D : the event that a subject disapproved of the president's job.

The following table below summaries:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Approve	192	158	795	163	1338
Disapprove	163	121	763	218	1235
	355	279	1558	381	2573

If we randomly select one of the subjects from this sample;

1. (4 points) What is the probability that they either {disapproved of a president's job} or {were polled in the first quarter}? Write the probability in terms of the events defined above. (Q_1, Q_2, and D) Round your answer to the nearest four decimal numbers.

2. (4 points) What is the probability they *approve* of the president's job and were polled in the second quarter? Write the probability in terms of the events defined above. (Q_1, Q_2, and D) Round your answer to the nearest four decimal numbers.

Copy of Problem 3 description from the previous page.

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Approve	192	158	795	163	1338
Disapprove	163	121	763	218	1235
	355	279	1558	381	2573

- Q_1 : the event that a subject was polled in the first quarter.
- Q_2 : the event that a subject was polled in the second quarter.
- D : the event that a subject disapproved of the president's job.

3. (4 points) What is the probability they disapproved of the job the current president was doing, *given that* they were polled in the second quarter? Write the probability in terms of the events defined above. (Q_1, Q_2, and D) Round your answer to the nearest four decimal numbers.

4. (3 points) What is the probability that they were polled in the first or fourth quarter *given that* they disapprove of the job President was doing? Let A be the event that a subject was polled in the first or the fourth quarter.

Problem 4. (22 points) Be sure to show all work for full credit.

Suppose the weights of eighteen-year-olds follow a normal distribution with mean 127 and standard deviation 12 (in pounds). We randomly sample 4 eighteen-year-olds and ask if their weight is larger than 127 pounds. You may find the following R command results helpful.

`pnorm(1.5) = 0.9331928;    qnorm(0.242) = -0.7;    qnorm(1 - 0.242) = 0.7`

1. (4 points) Let W represent the weight of a randomly selected eighteen-year-old. Write down the statistical notation for its distribution.

2. (4 points) Tom's weight is 145 pounds, what is his z-score? Interpret this z-score.

3. (4 points) What is the probability that Tom is lighter than a random selected teen? Round your answer to three decimal places.

4. (4 points) In order to be lighter than at least 24.2% of eighteen-year-olds, what is the maximum weight that Tom should have? Does he need to control his weight? Round your answer to one decimal place.

5. (2 points) We randomly sample 4 eighteen-year-olds and ask if their weight is larger than 127 pounds. Let V represent the number of teens who say they are heavier than 127 pounds. What is the distribution of V? Write down the statistical notation.

6. (4 points) What is the probability that fewer than 2 teens in our sample say they are heavier than 127 pounds? Show your work including formulas with numbers plugged in.

Problem 5. (12 points) Be sure to show all work for full credit.

It is reported that Facebook users spend an average of 190 minutes per month checking and updating their Facebook pages. Suppose that the current distribution of times spent per month checking and updating their Facebook pages by all users is normally distributed with a mean of 190 minutes and a standard deviation of 50 minutes. You may find the following R code helpful.

```
> pnorm( 0.2, mean=0, sd=1 )
[1] 0.5792
> pnorm( 0.4, mean=0, sd=1 )
[1] 0.6554
> qnorm( 0.1, mean=0, sd=1 )
[1] -1.2815
```

1. (4 points) Describe the center, shape, spread and distribution of the sampling distribution for the mean (average) time spent on Facebook each month based on a random sample of 4 users.

2. (4 points) Find the probability that the mean (average) time spent on Facebook each month will be within 10 minutes of the population mean based on a random sample of 4 users.

3. (4 points) Ten percent of samples of 4 Facebook users will have a mean (average) time greater than a. Find the value of a. Show all work for complete credit.

Name: _____

Lecture Section:	001	006	0011	016	021
Lecture time:	9:05 am	8:00 am	10:10 am	11:15 am	12:20 pm
(**Circle One**)	Zhang	Yang	Park	Park	Park

Question	Answer			
1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D

Please do NOT write in the following table. This is for grading purpose only!

Question	I	II	III	IV	V	100
Score						
Total	40	13	15	20	12	100