Exam 4 Test Prep

1. What is an experiment?

an occurrance with a result that is uncertain before experiment takes place

2. What is the sample space?

Where all solutions are found

$S = \{1, 2, 3, 4\}$

3. What is a simple event? Compound event?

Simple -> only 1 element. (ex: flipping a coin)

Compound -> more than 1 element (ex: spinning for prime#)

4. What is the theoretical approach?

assuming equally likely outcomes

5. What is the empirical approach?

results based on simulations or experiments

Now time to conduct an experiment!

a) Using the theoretical approach, what should the probability/frequency be?

50/50 chance. .5 probability

Roll the die 8 times, noting each time it is even/odd. Make it into a frequency table.

1	2	3	4	5	6	7	8
o	e	e	o	e	o	e	e

Even 5 **Odd** 3

b) Now for the table

Outcome	Frequency	Relative Freque
even	5	5/8 → .625
odd	3	3/8 → .375
total =	8	1

6. Make a frequency distribution table, including Test Score Intervals, Frequency, and Re
Frequency, from the following data set of 20 quiz scores:

15, 22, 18, 25, 11, 19, 21, 14, 28, 17, 23, 10, 26, 16, 20, 24, 13, 27, 12, 29

Test Score Intervals	Frequency	Relative Frequency
10 - 14	5	.25
15 - 19	5	.25
20 - 24	5	.25
25-29	5	.25
	20	1

7. What sign do we use for the union of A and B?

$A \cup B$

8. What sign do we use for the intersection of A and B?

$A \cap B$

9. How do we write the compliment of A?

A'

$\dot{A} = \{1, 3, 4, 9, 5\}$

$B = \{1, 5, 7, 6, 8\}$

10. What is the formula for finding the probability of A and B occurring (union)? What if they are mutually exclusive?

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Mutually exclusive = $P(A \cup B) = P(A) + P(B)$

11. In a standard deck of 52 playing cards, a single card is drawn. Find the probability of drawing a **Queen** or a **Black card**.

$\frac{4}{52}$ queens $\quad \frac{26}{52}$ black cards $\quad \frac{2}{52}$ are both

$\frac{4}{52} + \frac{26}{52} - \frac{2}{52} = \frac{28}{52} = \frac{7}{13}$

12. A travel agency surveyed 1,000 clients about their preferred vacation destinations.

- 650 clients prefer The Mountains. $650 - 100 = 550$ only mountain
- 450 clients prefer The Beach. $450 - 100 = 350$ only beach
- 100 clients prefer both The Mountains and The Beach.

If a client is chosen at random, what is the (empirical) probability that they prefer one of the two destinations but not both?

$\frac{550}{1000} + \frac{350}{1000} = \frac{900}{1000} = .9$ or 90%

13. A probability distribution must meet ~~two~~ 3 conditions:

- must equal 1 when added
- probabilities have to be between 0 and 1
- non-negative

14. Find the missing probability value

X	5	10	15	20	25
P(x)	0.15	0.10	.1	0.25	0.40

15. What is the mean? Median? Mode?

mean - average → $\frac{\text{sum of \#'s}}{\text{amt of \#'s}}$

median - middle data item

mode - data item that shows up the most

16. The following data represents the number of daily visitors to a small art gallery over a period of 15 days:

42, 35, 48, 55, 38, 42, 51, 40, 35, 48, 45, 42, 50, 39, 48

Mean 43.867

Median 42

Mode 48, 42

17. What is a population? What is the formula for population mean?

population → entire group

$$\mu = \frac{\Sigma x}{n}$$

18. What is a sample? What is the formula for sample mean?

Sample → portion of total

$$\overline{x} = \frac{\Sigma x}{n}$$

19. For each of the following scenarios, determine if the collected data represents a Population or a Sample.

Scenario 1: School Play Attendance

A local high school is planning its budget. They want to know the average number of students who attend the school play. They count the number of students at all 3 performances held this year.

Population or Sample?

Population: # of students at school plays

Sample: n/a

Scenario 2: Energy Drink Consumers

A large energy drink company wants to determine the average age of its consumers. They survey 1,000 people who purchased their product this week at a major grocery store chain across the country.

Population or Sample?

Population: n/a

Sample: 1000 people at certain stores

Scenario 3: Factory Production Time

A factory wants to measure the time it takes to assemble a specific circuit board. They time every single one of the 200 circuit boards assembled during the night shift.

Population or Sample?

Population: all circuit boards

Sample: n/a

20. The following data represents the daily commute times (in minutes) for 20 employees at a large company:

12, 18, 20, 24, 26, 30, 31, 35, 36, 39, 40, 42, 45, 48, 51, 53, 55, 59, 60, 64

Task: Construct a grouped frequency table using a class width of 10 and calculate the estimated mean.

Class Limit	Midpoint (x)	Frequency (y)	Product (x · y)
10-19	$\frac{10+11}{2}$ 14.5	2	29
20-29	24.5	3	73.5
30-39	34.5	5	172.5
40-49	44.5	4	178
50-59	54.5	4	218
60-69	64.5	2	129
Total	— — —	20	800

$\frac{800}{20} = 40$

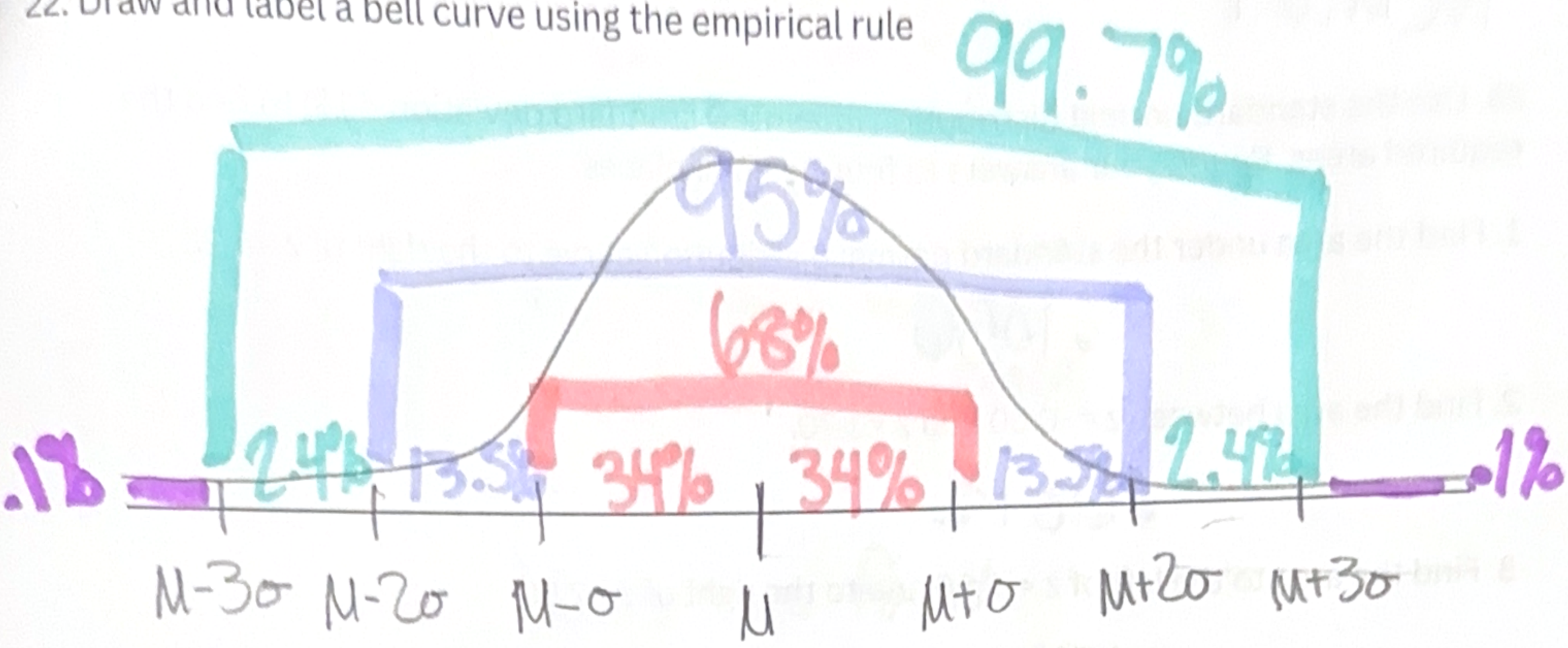
21. A technician measured the lifespan (in hours) of 5 different light bulbs in a test batch:

12, 10, 15, 11, 12

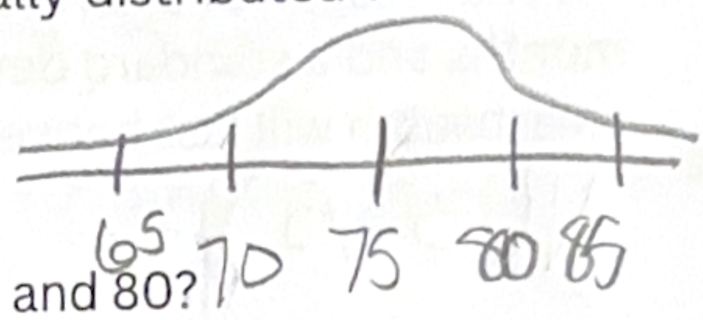
Task: Calculate the sample standard deviation for this dataset.

1.871

22. Draw and label a bell curve using the empirical rule



23. The final scores on a standardized chemistry exam are normally distributed with a mean of 75 and a standard deviation of 5.



Part A: The Empirical Rule

1. Approximately what percentage of students scored between 70 and 80?

68%

2. What range of scores includes the middle 95% of all students?

65-85

3. What percentage of students are expected to score above 85?

2.5%

Part B: Z-Score Calculations

The formula for the z-score is: $\frac{X-\mu}{\sigma}$

1. If a student scores an 83 on the exam, what is their z-score?

$X=83$ $\quad \frac{83-75}{5} = 1.6 \leftarrow$ z-score

2. If a student's z-score is -1.5, what was their actual exam score?

$\frac{x-75}{5} = -1.5$ $\quad$ 67.5 score

Part C: Relative Performance

1. Another student took a Physics exam where the scores were normally distributed with a mean of 65 and a standard deviation of 10. If the student scored a 75 on the Chemistry exam (mean 75, std dev 5) and a 75 on the Physics exam, on which test did the student perform better relative to their peers?

physics → $\frac{75-65}{10} = 1$ $\quad$ Chemistry → $\frac{75-75}{5} = 0$

N(M,σ)

24. Use the standard normal distribution (mean = 0 standard deviation = 1$) to find the required areas. Round your answers to four decimal places.

1. Find the area under the standard normal distribution curve to the right of z = 1.25.

.1056

2. Find the area between z = -0.60 and z = 1.70.

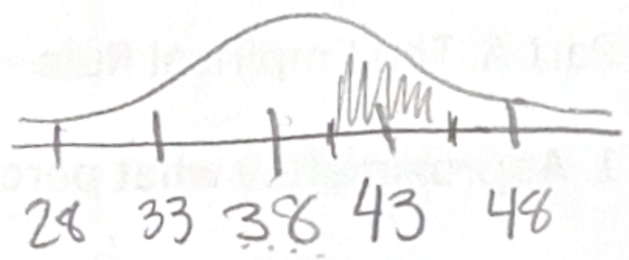
.6812

3. Find the area to the left of z = -2.50 and to the right of z = 2.50.

.0124

25. The lifespan of a certain brand of smartwatches is normally distributed with a mean of 38 months and a standard deviation of 5 months. Find the probability that a randomly selected smartwatch will last between 40 months and 45 months.

N(38,5)



.2638

26. The weights of apples harvested from a large orchard are normally distributed with a mean of 200 grams and a standard deviation of 25 grams.

A gourmet food store only buys the apples that are in the heaviest 10% of the harvest. What is the minimum weight (in grams) an apple must have to be purchased by the store?

N(200,25)

232 grams