

## Week 02 Quiz

### Problem 1

The ages (in years) of 10 employees in a company are:

**22, 25, 26, 28, 30, 32, 35, 40, 45, 50**

What is the 90th percentile of the employees' ages? [*Hint: if your answer is not listed, choose the one that is closest to your answer* ]

- A) 45
- B) 47.5
- C) 50
- D) 48.5

**Answer: B) 47.5**

*Explanation:* Position =  $0.90 \times 10 = 9.0$ . Since it's an integer, average the 9th and 10th values:  $(45+50)/2=47.5$ .

### Problem 2

The weights (in grams) of 9 apples are:

**100, 105, 110, 115, 120, 125, 130, 135, 140**

What is the 60th percentile of apple weights? [*Hint: if your answer is not listed, choose the one that is closest to your answer* ]

- A) 125
- B) 127.5
- C) 130
- D) 132.5

**Answer: A) 125**

*Explanation:* Position =  $0.60 \times 9 = 5.4$ . Since it's not an integer, 6th value, which is 125.)

### Problem 3

The five-number summary for monthly rainfall (in cm) in a city is:

**Minimum = 1.2, Q1 = 3.5, Median = 5.0, Q3 = 7.8, Maximum = 12.4**

What is the interquartile range (IQR)?

- A) 4.3 cm
- B) 5.6 cm
- C) 7.8 cm
- D) 11.2 cm

**Answer: A) 4.3 cm** \*(IQR = Q3 - Q1 = 7.8 - 3.5 = 4.3 cm.)\*

**Problem 4**

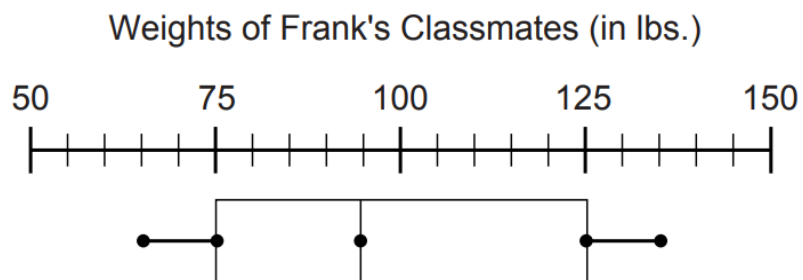
A dataset of 30 values has a minimum of 10 and a maximum of 100, but one extreme outlier (1000) is introduced. How does this affect the five-number summary?

- A) Only the maximum changes
- B) Q1, Q3, and median change
- C) Only the minimum and maximum change
- D) The entire five-number summary changes

**Answer: A) Only the maximum changes**  
*(Outliers affect only the min/max, not quartiles or median, unless they shift the data distribution drastically.)*

**Problem 5**

According to the following box-and-whisker plot, what was the lower quartile weight of Frank's classmates?



- (a) 65
- (b) 95

(c) 75

(d) 125

**Answer c**

### Problem 6

For a population with  $\mu = 80$  and  $\sigma = 12$ , what is the z-score corresponding to  $X = 71$ ?

A). -0.50

B). -0.75

C). -1.00

D). -1.5

**Answer B**

### Problem 7

For a population with  $\sigma = 10$ , a score of  $X = 60$  corresponds  $z = -1.5$ . What is the population mean?

A). 30

B). 45

C). 75

D). 90

**Answer C**

$$(60 - \mu)/10 = -1.5 \rightarrow 60 - \mu = -1.5 * 10 = -15 \rightarrow \mu = 60 + 1.5 * 10 = 75$$

### Problem 8

A weather station forecasts a 40% chance of rain on Saturday and a 50% chance of rain on Sunday. There is a 20% chance it rains on both days. What is the probability that it rains on at least one of the weekend days?

a) 70%

b) 90%

c) 20%

d) 30%

**Answer: a) 70%**

Using the addition rule:  $P(\text{Sat or Sun}) = P(\text{Sat}) + P(\text{Sun}) - P(\text{both}) = 0.4 + 0.5 - 0.2 = 0.7$ .

### Problem 9

Candidate passes first interview with probability 0.6. If passes first, probability of passing second is 0.8. What is probability of passing both interviews?

- a) 0.48
- b) 0.8
- c) 0.6
- d) 1.4

**Answer: a) 0.48**

Multiplication rule:  $P(\text{both}) = P(\text{first}) \times P(\text{second}|\text{first}) = 0.6 \times 0.8 = 0.48$ .

### Problem 10

Probability a household subscribes to streaming service S is 0.5, to service T is 0.4. If they subscribe to S, probability they also subscribe to T is 0.6. Find  $P(S \cup T)$ .

- a) 0.6
- b) 0.9
- c) 0.7
- d) 0.8

**Answer: a) 0.6**

First,  $P(S \cap T) = P(S)P(T|S) = 0.5 \times 0.6 = 0.3$ . Then  $P(S \cup T) = 0.5 + 0.4 - 0.3 = 0.6$ .

### Problem 12

Probability a new product succeeds in market A is 0.4. If succeeds in A, probability it succeeds in market B is 0.7. What is probability it succeeds in both markets?

- a) 0.28
- b) 1.1
- c) 0.3
- d) 0.7

**Answer: a) 0.28**

$P(A \cap B) = P(A) \times P(B|A) = 0.4 \times 0.7 = 0.28$ .

### Problem 12

Probability a student takes Math is 0.6, takes History is 0.5. Probability they take at least one is 0.8. What is the probability they take both?

- a) 0.3
- b) 1.1
- c) 0.8
- d) 0.1

**Answer: a) 0.3**

$$P(M \cap H) = P(M) + P(H) - P(M \cup H) = 0.6 + 0.5 - 0.8 = 0.3.$$

### Problem 13

A pizza shop's delivery count  $X$  has PMF:  $P(X=0)=0.1$ ,  $P(X=1)=0.3$ ,  $P(X=2)=0.4$ ,  $P(X=3)=0.2$ . What is  $P(X \leq 2)$ ?

- a) 0.7
- b) 0.8
- c) 0.9
- d) 0.4

**Answer: b) 0.8**

$$P(X \leq 2) = P(X=0) + P(X=1) + P(X=2) = 0.1 + 0.3 + 0.4 = 0.8.$$

### Problem 14

A bus arrives at a station uniformly between 8:00 AM and 8:30 AM. If  $X$  is the number of minutes after 8:00 AM that the bus arrives, what kind of random variable is  $X$ , and what is its probability density function (PDF) between 0 and 30?

- a) Discrete;  $P(X = x) = \frac{1}{30}$  for  $x = 0, 1, \dots, 30$
- b) Continuous;  $f(x) = \frac{1}{30}$  for  $0 \leq x \leq 30$
- c) Continuous;  $f(x) = 30$  for  $0 \leq x \leq 30$
- d) Discrete;  $P(X = x) = 30$  for all  $x$

**Answer: b)**

Time is continuous, uniform over  $[0, 30]$ . PDF height =  $\frac{1}{30}$  so area = 1.

### Problem 15

The daily high temperature in a city in June is modeled as a continuous random variable ranging from 20°C to 35°C. If all temperatures in that range are equally likely, what is  $P(25 \leq X \leq 30)$ ?

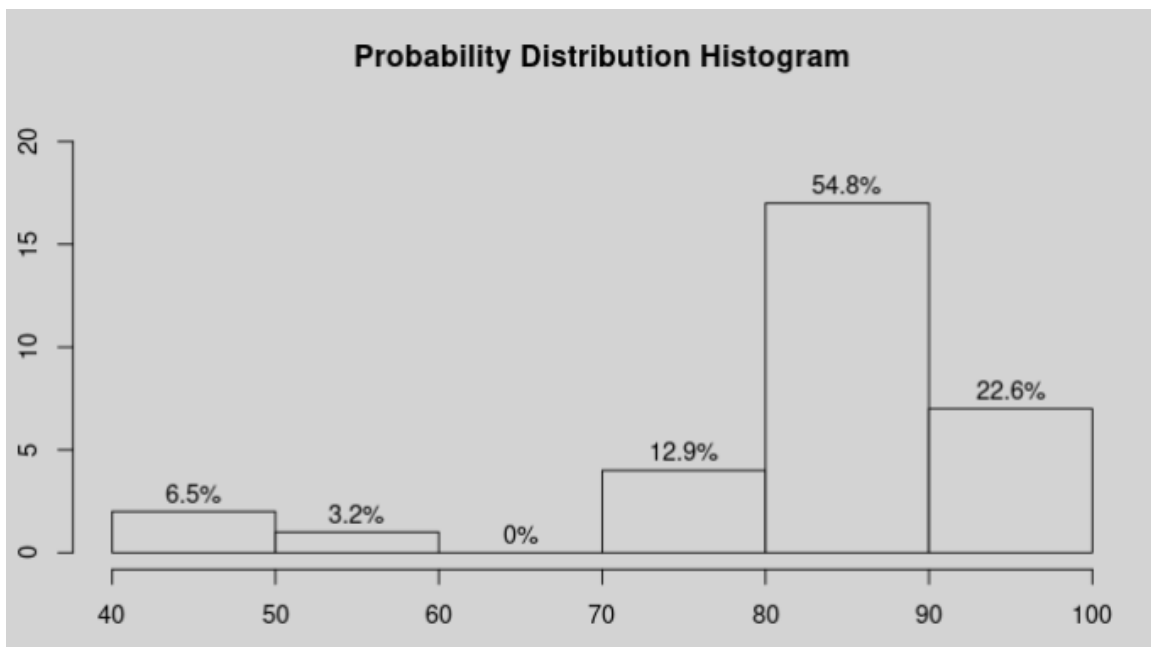
- a)  $\frac{1}{15}$
- b)  $\frac{1}{3}$
- c)  $\frac{4}{15}$
- d)  $\frac{2}{15}$

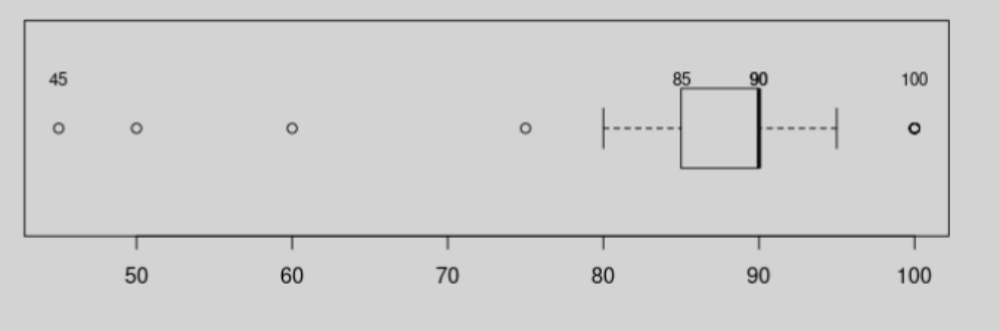
**Answer: b)**

Uniform on  $[20,35] \rightarrow$  width = 15. Desired interval width = 5  $\rightarrow$  probability =  $\frac{5}{15} = \frac{1}{3}$ .

## Summary of Weekly Assignment #2

cut.data.freq	Freq	midpts	rel.freq	cum.freq	rel.cum.freq
[4e+01,5e+01]	2	45.00	0.07	2	0.07
(5e+01,6e+01]	1	55.00	0.03	3	0.10
(6e+01,7e+01]	0	65.00	0.00	3	0.10
(7e+01,8e+01]	4	75.00	0.13	7	0.23
(8e+01,9e+01]	17	85.00	0.55	24	0.77
(9e+01,1e+02]	7	95.00	0.23	31	1.00





stats	value
Min.	45.00
1st Qu.	85.00
Median	90.00
3rd Qu.	90.00
Max.	100.00