

## Week 03 Quiz

### Problem 1.

Three unbiased coins are tossed. What is the probability of getting at least two heads?

- A)  $6/8$
- B)  $4/8$
- C)  $7/8$
- D)  $3/8$

**Answer: B.**

Hint: list all possible outcomes in the sample space. This is essentially the same as the example of the “three-kid” problem we worked on in class.

### Problem 2

You decide to conduct a survey of families with two children. You are interested in counting the number of boys (out of 2 children) in each family. Is this a random variable, and if it is, what are all its possible values?

- A. Yes, it is a random variable, and its values can be 1 and 2.
- B. Yes, it is a random variable, and its values are 0, 1, or 2.
- C. Yes, it is a random variable, and its values can be 2 or 4.
- D. No, it is not a random variable since it is not random.

**Answer: B**

Use the definition of the random variable.

### Problem 3

Which of the following is **NOT** a property of a random variable?

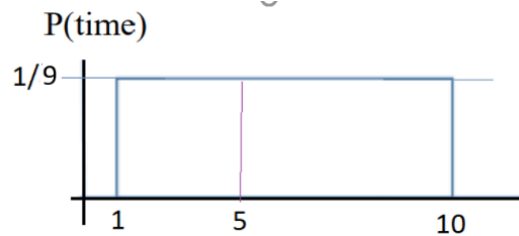
- A. The sum of the probabilities of a discrete random variable is equal to 1.
- B. The distribution function of a random variable cannot be negative.
- C. A random variable must be less than or equal to 1 and greater than or equal to 0.
- D. A random variable can be discrete or continuous.

**Answer: C**

Use the definition of the random variable.

### Problem 4.

The following uniform distribution describes the wait time (in minutes) for passengers of the bus at a stop at the airport. What is the probability that a randomly selected passenger will wait between 5 and 10 minutes?



- A.  $5/10$
- B.  $5/9$
- C.  $4/9$
- D.  $4/10$

**Answer: B**

Calculate the area of the region between 5 and 10. It is a rectangle:  $(10-5) \times (1/9) = 5/9$ .

#### Problem 5

Suppose the time to wait for placing an order at a drive-through window has a uniform distribution between 0 and 8 minutes. What is the probability that a randomly selected customer will wait for exactly 5 minutes?

- A.  $5/8$
- B.  $3/8$
- C. 0
- D.  $1/8$

**Answer: C**

This is a uniform distribution. It is a continuous random variable. The probability of taking a single value is always 0.

#### Problem 6

Which of the following random variables should be considered continuous?

- A. The time it takes for a randomly chosen woman to run 100 meters.
- B. The number of brothers a randomly chosen person has.
- C. The number of cars owned by a randomly chosen adult male.

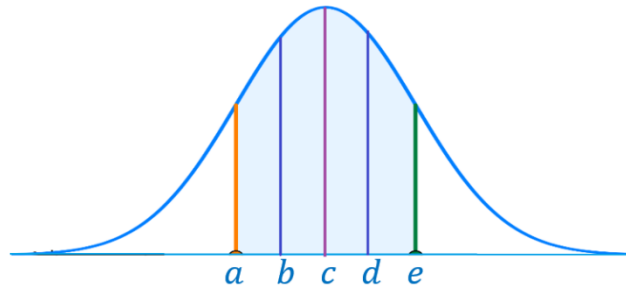
D. The number of orders received by a mail-order company in a randomly chosen week.

**Answer: A**

Time is a typical continuous variable. B-C are counts (number of ....).

### Problem 7

Assume the density curve of a continuous random variable is given below. A, b, c, d, and e are four distinct values of the random variable. Let  $E = \{a, b, c, d, e\}$ .



Find the probability  $P(E)$ .

- A.  $1/5$
- B.  $1/3$
- C. 0
- D.  $1/(a+b+c+d+e)$

**Answer: C.**

The density curve indicates the continuity of the random variable. The probability of observing individual values is always 0.  $P(a) = P(b) = P(c) = P(d) = P(e) = 0$ . Therefore, the sum of these probabilities is also 0.

### Problem 8.

Assume that the time required to receive confirmation that an electronic transfer has occurred is **uniformly** distributed between 30 and 90 seconds. What is the probability that a randomly selected transfer will take less than 75 seconds?

- A.  $15/60$
- B.  $15/90$
- C.  $30/90$
- D.  $45/60$

**Answer: D**

Use the area formula of the rectangle to find the probability: height =  $1/(90-30) = 1/60$ , width =  $(75 - 30) = 45$  ("less than"). The probability =  $45/60$ .

### Problem 9

The table below reflects the student population at a fictional high school, where lower classmen refer to freshmen and sophomores and upperclassmen refer to juniors and seniors.

	Lower Classman	Upper Classman	Row Totals
Male	241	197	438
Female	189	213	402
Column Totals	430	410	840

Randomly select a student, what is the probability that the student is an upper-classman student?

- A.  $430/840$
- B.  $410/840$
- C.  $213/410$
- D.  $197/840$

**Answer: B.** Randomly select a student from the population (all students).

### Problem 10

The table below reflects the student population at a fictional high school, where lower classmen refer to freshmen and sophomores and upperclassmen refer to juniors and seniors.

	Lower Classman	Upper Classman	Row Totals
Male	241	197	438
Female	189	213	402
Column Totals	430	410	840

Randomly select a male student, what is the probability that the student is an upperclassman?

- a. 197/438
- b. 213/402
- c. 197/410
- d. 197/840

**Answer: A.** note that the selected student is restricted to male students.

### Problem 11

What is the sample space for flipping a fair coin 3 times?

- A. HHH HTH THT TTT
- B. HHH HHT HTH THH TTH THT HTT TTT
- C. HHH HHT HTH THH TTT
- D. HHT HTH THH TTH THT HTT

**Answer. B**

### Problem 12

A discrete random variable has the probability distribution seen below. What is the probability that  $x$  is greater than 2?

$x$	0	1	2	3	4	5
$P(X = x)$	0.05	0.15	0.10	0.25	0.30	0.15

- A. 0.10
- B. 0.20
- C. 0.80
- D. 0.70

**Answer: D.**  $P(x > 2) = P(x=3) + P(x=4) + P(x=5) = 0.25 + 0.3 + 0.15 = 0.7$

## Summary of Quiz #3

### 1. Five Number Summary :

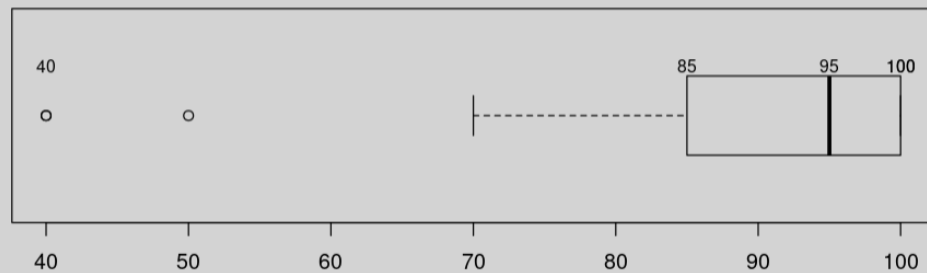
The five-number summary is used to describe the shape of the distribution of a given numerical data. It consists of five numbers: minimum data value, first quartile, median, the third quartile, and the maximum data value.

The five-number summary of this given data set is:

stats	value
Min.	40.00
1st Qu.	85.00
Median	95.00
3rd Qu.	100.00
Max.	100.00

### 2. Boxplot :

The boxplot is a geometric representation of the five-number summary. The boxplot of the given data set is given below.



Probability Distribution Histogram

