#### Week 3 Practice Quiz

**TOTAL POINTS 3**

1.

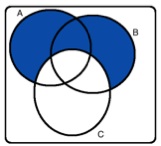
Question 1

Shown below are four Venn diagrams. In which of the diagrams does the shaded area represent A and B and C?

**1 / 1 point**

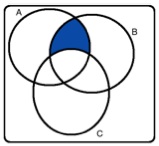


I.



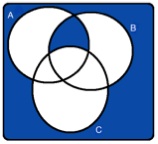


II.



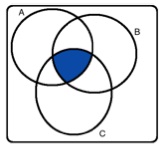


III.





Iv.



**Correct**

This question refers to the following learning objective: Draw Venn diagrams representing events and their probabilities.

We need the area shared by all events, the intersection of all three circles: “A and B and C”.

2.

Question 2

Which of the following is **false** about probability distributions?

**1 / 1 point**



Each probability should be positive, less than or equal to 1.



The outcomes listed must be independent.



The probabilities must total 1.



Each probability should be greater than or equal to 0.

**Correct**

This question refers to the following learning objective: Define a probability distribution as a list of the possible outcomes with corresponding probabilities that satisfies three rules:

* The outcomes listed must be disjoint.
* Each probability must be between 0 and 1.
* The probabilities must total 1.

There is no such restriction that we must only list independent outcomes.

3.

Question 3

Last semester, out of 170 students taking a particular statistics class, 71 students were “majoring” in social sciences and 53 students were majoring in pre-medical studies. There were 6 students who were majoring in both pre-medical studies and social sciences. What is the probability that a randomly chosen student is majoring in social sciences, given that s/he is majoring in pre-medical studies?

**1 / 1 point**



6/71



(71+53−6)/170



6/53



6/170

**Correct**

This question refers to the following learning objective: Distinguish marginal and conditional probabilities.

If M is the event a student is majoring in pre-medical studies and S is the event s/he is majoring in social sciences, then calculate P(S|M) = \frac{P(S \& M)}{P(M)} = \frac{6}{53}*P*(*S*∣*M*)=*P*(*M*)*P*(*S*&*M*)​=536​.

Lesson Learning Objectives

**Suggested reading:**[OpenIntro Statistics, 3rd edition](https://www.openintro.org/stat/textbook.php?stat_book=os), Chapter 2, Section 2.1

**LO 1.** Define the probability of an outcome as the proportion of times the outcome would occur if we observed the random process that gives rise to it an infinite number of times.

**LO 2.**Explain why the long-run relative frequency of repeated independent events settles down to the true probability as the number of trials increases, i.e. why the law of large numbers holds.

**LO 3.** Define disjoint (mutually exclusive) events as events that cannot both happen at the same time:

* If A and B are disjoint, P(A and B) = 0

**LO 4.**Distinguish between disjoint and independent events.

* If A and B are independent, then having information on A does not tell us anything about B (and vice versa).
* If A and B are disjoint, then knowing that A occurs tells us that B cannot occur (and vice versa).
* Disjoint (mutually exclusive) events are always dependent since if one event occurs we know the other one cannot.

**LO 5.** Draw Venn diagrams representing events and their probabilities.

**LO 6.** Define a probability distribution as a list of the possible outcomes with corresponding probabilities that satisfies three rules:

* The outcomes listed must be disjoint.
* Each probability must be between 0 and 1.
* The probabilities must total 1.

**LO 7.** Define complementary outcomes as mutually exclusive outcomes of the same random process whose probabilities add up to 1.

* If A and B are complementary, P(A) + P(B) = 1

**LO 8.** Distinguish between union of events (A or B) and intersection of events (A and B).

* Calculate the probability of union of events using the (general) addition rule:

    If A and B are not mutually exclusive, P(A or B) = P(A) + P(B) − P(A and B)

    If A and B are mutually exclusive, P (A or B) = P (A) + P (B), since for mutually exclusive events P(A and B) = 0

* Calculate the probability of intersection of independent events using the multiplication rule:

    If A and B are independent, P(A and B) = P(A) × P(B)

    If A and B are dependent, P(A and B) = P(A|B) × P(B)

***Test yourself:***

*1. What is the probability of getting a head on the 6th coin flip if in the first 5 flips the coin landed on a head each time?*

*2. True / False: Being right handed and having blue eyes are mutually exclusive events.*

*3. P(A) = 0.5, P(B) = 0.6, and there are no other possible outcomes in the sample space. What is P(A and B)?*

## Lesson Learning Objectives

**Suggested reading:** [OpenIntro Statistics, 3rd edition](https://www.openintro.org/stat/textbook.php?stat_book=os), Chapter 2, Section 2.2

**LO 1.** Distinguish between marginal and conditional probabilities.

**LO 2.** Construct tree diagrams to calculate conditional probabilities and probabilities of intersection of non-independent events using Bayes’ theorem: P(A|B) = \frac{P(A~and~B)}{P(B)}*P*(*A*∣*B*)=*P*(*B*)*P*(*A* *and* *B*)​

***Test yourself:***50% of students in a class are social science majors and the rest are not. 70% of the social science students and 40% of the non-social science students are in a relationship. Create a contingency table and a tree diagram summarizing these probabilities. Calculate the percentage of students in this class who are in a relationship.

## Suggested Readings and Practice

**Suggested reading for this week:**[OpenIntro Statistics, 3rd edition](https://www.openintro.org/stat/textbook.php?stat_book=os), Chapter 2, Sections 2.1 and 2.2

**Practice exercises:**End of chapter exercises Chapter 2: 2.1, 2.3, 2.5, 2.7, 2.13, 2.15, 2.19, 2.21, 2.23

(Reminder: the solutions to the end of chapter exercises are at the end of the OpenIntro Statistics book)

#### Week 3 Quiz

**LATEST SUBMISSION GRADE**

100%

1.

Question 1

Which of the following explains the phenomenon that while in 10 flips of a fair coin it may not be very surprising to get 8 Heads, it would be very surprising to get 8,000 Heads in 10,000 flips of the coin.

**1 / 1 point**



Law of averages



Bayes’ theorem



Law of large numbers



General addition rule

**Correct**

This question refers to the following learning objective: Explain why the long-run relative frequency of repeated independent events settles down to the true probability as the number of trials increases, i.e. why the law of large numbers holds.

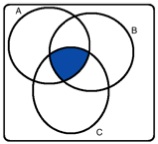
2.

Question 2

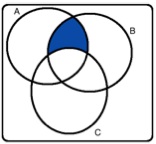
Shown below are four Venn diagrams. In which of the diagrams does the shaded area represent A and B but not C?

**1 / 1 point**

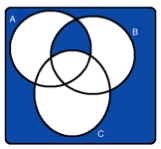




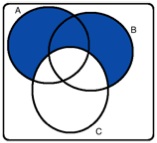












**Correct**

This question refers to the following learning objective: Draw Venn diagrams representing events and their probabilities.

We need the area common to events A and B to be entirely shaded except for that portion common to event C: “A and B but not C”.

3.

Question 3

Each choice below shows a suggested probability distribution for letter grades in a class (Possible grades are A, B, C, or D or lower). Determine which is a proper probability distribution.

**1 / 1 point**



A: 0.10, B: 0.20, C: 0.50, D or lower: 0.10



A: 0.20, B: 0.40, C: 0.50, D or lower: -0.10



A: 0.30, B: 0.30, C: 0.30, D or lower: 0.30



A: 0.30, B: 0.30, C: 0.40, D or lower: 0

**Correct**

This question refers to the following learning objective: Define a probability distribution as a list of the possible outcomes with corresponding probabilities that satisfies three rules:

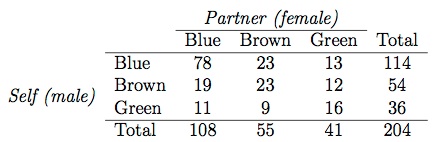
* The outcomes listed must be disjoint.
* Each probability must be between 0 and 1.
* The probabilities must total 1.

Sum of all probabilities must equal 1 and each probability must be a value between 0 and 1.

4.

Question 4

Assortative mating is a nonrandom mating pattern where individuals with similar genotypes and/or phenotypes mate with one another more frequently than what would be expected under a random mating pattern. Researchers studying this topic collected data on eye colors of 204 Scandinavian men and their female partners. The table below summarizes the results. For simplicity, assume heterosexual relationships. What is the probability that a randomly chosen couple is comprised of a male and female with blue eyes?



(Reference: Laeng, Bruno, Ronny Mathisen, and Jan-Are Johnsen. “Why do blue-eyed men prefer women with the same eye color?.” Behavioral Ecology and Sociobiology 61.3 (2007): 371-384.)

**1 / 1 point**



(108+114−78)/204



78/204



78/114



78/108

**Correct**

This question refers to the following learning objective: Distinguish marginal and conditional probabilities.

Among all 204 pairs, 78 of them have partners both with blue eyes.

5.

Question 5

Which of the following statements is **false**?

**1 / 1 point**



Two mutually exclusive outcomes (of the same event) cannot occur at the same time.



Two disjoint outcomes (of the same event) cannot occur at the same time.



Two independent events cannot occur at the same time.



Two complementary outcomes (of the same event) cannot occur at the same time.

**Correct**

This question refers to the following learning objective(s):

Define disjoint (mutually exclusive) events as events that cannot both happen at the same time: If A and B are disjoint, P(A and B) = 0.

Distinguish between disjoint and independent events.<br>

* If A and B are independent, then having information on A does not tell us anything about B (and vice versa).
* If A and B are disjoint, then knowing that A occurs tells us that B cannot occur (and vice versa).
* Disjoint (mutually exclusive) events are always dependent since if one event occurs we know the other one cannot.

Independent events are not necessarily mutually exclusive.