STATISTICS

A STATISTICAL INVESTIGATION PROCESS

A.1 A STEP-BY-STEP INVESTIGATION

A.1.1 IDENTIFYING THE STEPS OF AN INQUIRY

MCQ 1: Read the statement: "The girls' average score in math is 87, while the boys' average is 75. Since $87 > 75$, this data suggests that, on average, the girls in this group performed better."
Which step of the statistical process does this describe?

- ☐ Step 1: Pose the Question
- ☐ Step 2: Collect Data
- ☐ Step 3: Analyze Data
- ☐ Step 4: Represent Data (e.g., create charts)
- ☐ Step 5: Interpret the Results

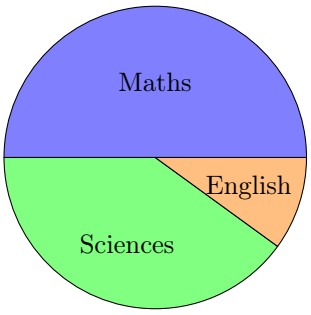
MCQ 2: Read the statement: "Our investigation will explore whether students in our school prefer science over math."
Which step of the statistical process does this describe?

- ☐ Step 1: Pose the Question
- ☐ Step 2: Collect Data
- ☐ Step 3: Analyze Data
- ☐ Step 4: Represent Data
- ☐ Step 5: Interpret the Results

MCQ 3: Read the statement: "We asked every student in the school to fill out a survey about their favorite subject."
Which step of the statistical process does this describe?

- ☐ Step 1: Pose the Question
- ☐ Step 2: Collect Data
- ☐ Step 3: Analyze Data
- ☐ Step 4: Represent Data
- ☐ Step 5: Interpret the Results

MCQ 4: Read the statement: "We made a pie chart showing the proportion of students who chose each subject."



Which step of the statistical process does this describe?

- ☐ Step 1: Pose the Question
- ☐ Step 2: Collect Data
- ☐ Step 3: Analyze Data
- ☐ Step 4: Represent Data
- ☐ Step 5: Interpret the Results

MCQ 5: Read the statement: "The relative frequency of students choosing 'Math' as their favorite subject is 32%."
Which step of the statistical process does this describe?

- ☐ Step 1: Pose the Question
- ☐ Step 2: Collect Data
- ☐ Step 3: Analyze Data
- ☐ Step 4: Represent Data
- ☐ Step 5: Interpret the Results

B STEP 1: POSING THE QUESTION

B.1 KEY CONCEPTS OF THE INQUIRY

B.1.1 IDENTIFYING POPULATIONS

MCQ 6: **Your Question:** "How many hours do **kids** spend playing outside each day?"
Which group is the correct **population** to survey?

- ☐ All adults in a city.
- ☐ All kids in a school.
- ☐ All dogs in a neighborhood.
- ☐ All teachers in a country.

MCQ 7: **Your Question:** "How many **families** own a pet in **our town**?"
Which group is the correct **population** to survey?

- ☐ All kids in a playground.
- ☐ All birds in a forest.
- ☐ All workers in a factory.
- ☐ All families in our town.

MCQ 8: **Your Question:** "How many books do **students** borrow from the **school library** each month?"
Which group is the correct **population** to survey?

- ☐ All librarians in a state.
- ☐ All students in the school.
- ☐ All books in a bookstore.
- ☐ All parents in a neighborhood.

MCQ 9: **Your Question:** "How tall are the **oak trees** in a **national park**?"
Which group is the correct **population** to study?

- ☐ All oak trees in the national park.
- ☐ All rivers in a country.
- ☐ All clouds in the sky.
- ☐ All rocks on a mountain.

B.1.2 CLASSIFYING DATA TYPES

MCQ 10: **Data:** Favorite subject (e.g., Math, Science, English).
Think: Is this a category or a number you can measure?

☐ Quantitative variable

☐ Qualitative variable

MCQ 11: **Data:** Number of siblings.
Think: Is this a category or a number you can count?

☐ Quantitative variable

☐ Qualitative variable

MCQ 12: **Data:** Type of vehicle (e.g., car, bicycle, bus).
Think: Is this a category or a number you can measure?

☐ Quantitative variable

☐ Qualitative variable

MCQ 13: **Data:** Height of students (in cm).
Think: Is this a category or a number you can measure?

☐ Quantitative variable

☐ Qualitative variable

MCQ 14: **Data:** Level of education (e.g., high school, bachelor's, master's).
Think: Is this a category or a number you can measure?

☐ Quantitative variable

☐ Qualitative variable

MCQ 15: **Data:** Annual income (in dollars).
Think: Is this a category or a number you can count or measure?

☐ Quantitative variable

☐ Qualitative variable

B.2 SURVEY DESIGN AND QUESTION FORMULATION

B.2.1 DESIGNING QUESTIONS FOR DATA TYPES

Ex 16: **Goal:** Collect **quantitative (numerical)** data about music.
Write a survey question that will give you answers that are numbers.

Ex 17: **Goal:** Collect **qualitative (categorical)** data about music.
Write a survey question that will give you answers that are words or categories.

Ex 18: **Goal:** Collect **qualitative (categorical)** data about food.
Write a survey question that will give you answers that are words or categories.

Ex 19: **Goal:** Collect **quantitative (numerical)** data about food.
Write a survey question that will give you answers that are numbers.

B.2.2 EVALUATING SURVEY QUESTIONS

MCQ 20: **Scenario:** A cafeteria manager wants to survey students to improve the menu.
Proposed Question: "How often do you buy lunch at school? (a) Daily, (b) 2–3 times a week, (c) Rarely, (d) Never"
Classify this question.

☐ Structured.

☐ Unstructured.

MCQ 21: **Scenario:** A cafeteria manager wants to survey students to improve the menu.
Proposed Question: "Do you like the current lunches and why?"
Classify this question.

☐ Structured, and well-formulated.

☐ Structured, but it is a leading question.

☐ Unstructured, and well-formulated.

☐ Unstructured, but it is a "double-barreled" question.

MCQ 22: **Scenario:** A cafeteria manager wants to survey students.
Proposed Question: "Don't you think the lunches are too expensive and unhealthy?"
What is the primary flaw of this question?

☐ It is too personal.

☐ It is a leading and double-barreled question.

☐ The options are not exhaustive.

☐ It is ambiguous.

MCQ 23: **Scenario:** A cafeteria manager wants to survey students.
Proposed Question: "On a scale of 1 to 5, how satisfied are you with the variety, taste, and price of the lunches?"
This question is structured, but what is its primary flaw?

☐ It is a "triple-barreled" question.

☐ It is a leading question.

☐ The scale is not clearly defined.

☐ It is too personal.

B.2.3 CRITIQUING AND REWRITING SURVEY QUESTIONS

Ex 24: Scenario: A cafeteria manager wants to survey students about the price of lunches.
Proposed Question: "Don't you think the lunches are too expensive?"
Critique this question and propose a better structured (closed-ended) and unstructured (open-ended) version.

Ex 25: Scenario: A cafeteria manager wants to measure student satisfaction.
Proposed Question: "How satisfied are you with the quality and the price of the lunches?"
Critique this question and rewrite it properly.

Ex 26: Scenario: A cafeteria manager wants feedback on a new menu.
Proposed Question: "How great is the new eco-friendly menu? Choose one: Excellent, Very good, Good."
Critique this question and rewrite it properly.

Ex 27: Scenario: A cafeteria manager wants to understand student dissatisfaction.
Proposed Question: "Why do you hate the cafeteria food?"
Critique this question and rewrite it properly.

C STEP 2: COLLECTING DATA

C.1 CENSUS VS. SAMPLING

C.1.1 CHOOSING THE RIGHT DATA COLLECTION METHOD

MCQ 28: Scenario: You need to elect the Grade 7 class representative.
Which method should be used to ensure a fair result?

☐ Survey

☐ Census

MCQ 29: Scenario: You want to estimate the average amount of soda Grade 7 students drink per week across the entire country.
Which method is more practical?

☐ Survey

☐ Census

MCQ 30: Scenario: A teacher wants to know the exact number of students in their own class who have a pet.
Which method should be used for an accurate count?

☐ Survey

☐ Census

MCQ 31: Scenario: Researchers want to estimate the average number of hours Grade 7 students sleep per night in a large city.
Which method is more practical?

☐ Survey

☐ Census

MCQ 32: Scenario: A large food company wants to find out the most popular new snack flavor among teenagers across the country before launching it.
Which method should the company use?

☐ Survey

☐ Census

C.2 SAMPLING METHODS AND POTENTIAL FOR ERROR

C.2.1 IDENTIFYING SAMPLING METHODS

MCQ 33: Scenario: A researcher wants to survey 100 students in a high school of 1000. The school population is divided by grade: 9th (250), 10th (300), 11th (250), and 12th (200). The researcher randomly selects 25 students from 9th grade, 30 from 10th, 25 from 11th, and 20 from 12th.
What type of sampling method is being used?

☐ Simple random sampling

☐ Systematic sampling

☐ Convenience sampling

☐ Stratified sampling

☐ Quota sampling

MCQ 34: Scenario: A researcher wants to survey 100 students in a high school of 1000. The researcher assigns each student a unique number and uses a random number generator to select 100 students to survey.
What type of sampling method is being used?

☐ Simple random sampling

☐ Systematic sampling

☐ Convenience sampling

☐ Stratified sampling

☐ Quota sampling

MCQ 35: **Scenario:** A researcher wants to survey 100 students in a high school of 1000. The researcher obtains an alphabetized list of all students and selects every 10th student, starting from the 5th person on the list.
What type of sampling method is being used?

☐ Simple random sampling

☐ Systematic sampling

☐ Convenience sampling

☐ Stratified sampling

☐ Quota sampling

MCQ 36: **Scenario:** A researcher wants to survey 100 students in a high school. The researcher stands in the cafeteria and surveys the first 100 students who agree to participate.
What type of sampling method is being used?

☐ Simple random sampling

☐ Systematic sampling

☐ Convenience sampling

☐ Stratified sampling

☐ Quota sampling

C.2.2 APPLYING SYSTEMATIC SAMPLING

Ex 37: **Scenario:** A factory produces 10,000 bottles per day and wants to test a 2% sample for quality. The operator uses a systematic sample, starting from the 23rd bottle.

1. Calculate the total size of the sample.

   ☐ bottles

2. List the numbers of the first three bottles to be sampled.

   ☐, ☐, ☐

Ex 38: **Scenario:** A factory produces 80,000 chocolate bars per day and wants to test a 0.5% sample. The operator uses a systematic sample, starting from the 17th bar.

1. Calculate the total size of the sample.

   ☐ bars

2. List the numbers of the first three bars to be sampled.

   ☐, ☐, ☐

Ex 39: **Scenario:** A publisher prints 5,000 books per day and wants to check a 4% sample. They use a systematic sample, starting from the 10th book.

1. Calculate the total size of the sample.

   ☐ books

2. List the numbers of the first three books to be sampled.

   ☐, ☐, ☐

Ex 40: **Scenario:** A car manufacturer assembles 500 cars per day and wants to safety test a 10% sample. They use a systematic sample, starting from the 5th car.

1. Calculate the total size of the sample.

   ☐ cars

2. List the numbers of the first three cars to be sampled.

   ☐, ☐, ☐

C.2.3 EVALUATING SAMPLING METHODS

Ex 41: **Scenario:** A marketing manager wants to test whether a new product will appeal to the public. He surveys only the employees who developed the product.
Conclusion: "The product will be a success with all consumers."

1. Identify the sampling method.
2. Discuss the main problems with this sampling method and conclusion.
3. Suggest a more appropriate sampling method.

Ex 42: **Scenario:** A city planner surveys a large, diverse, and randomly selected group of residents, stratified by age, about a proposed new park.
Conclusion: "The majority of residents support the new park."

1. Identify the sampling method used.
2. Explain why this method is appropriate.
3. What potential sources of non-sampling error could still affect the conclusion?

Ex 43: Scenario: A food festival averages 4,200 visitors. The manager wants to estimate the proportion of visitors who will spend more than $30. He decides to survey the first 50 people who enter.

1. Identify the sampling method.
2. Discuss the problems with this method.
3. Suggest a better sampling method.

Ex 44: Scenario: A nutritionist tests a new diet's effectiveness by selecting clients from her own clinic. They all report significant weight loss.
Conclusion: "The diet works for everyone."

1. Identify the sampling method and key threats to the study's validity.
2. Critique the conclusion.

C.2.4 IDENTIFYING FLAWS IN STATISTICAL REASONING

MCQ 45: Scenario: A teacher wants to gauge how students feel about his lessons. He surveys only the 5 students who sit in the front row.
Conclusion Drawn: "All of my students enjoy my teaching."
Which statements are true about this conclusion? Check all that apply:

- ☐ The conclusion is reliable and accurate.
- ☐ The conclusion is likely flawed due to a small sample size.
- ☐ The conclusion is likely flawed due to selection bias.

MCQ 46: Scenario: A company wants to test if a new product will be popular. The manager surveys only the employees who helped develop the product.
Conclusion Drawn: "The product will be a success with all consumers."
Which statements are true about this conclusion? Check all that apply:

- ☐ The manager's conclusion is reliable and accurate.
- ☐ The manager's conclusion could be flawed due to a small sample size.
- ☐ The manager's conclusion is flawed due to selection bias.

MCQ 47: Scenario: A city planner surveys a large, diverse, and randomly selected group of residents from all neighborhoods and age groups about a new park.
Conclusion Drawn: "The majority of residents support the new park."
Which statement best describes this conclusion?

- ☐ The planner's conclusion is likely reliable and accurate.
- ☐ The planner's conclusion is flawed due to a small sample size.
- ☐ The planner's conclusion is flawed due to selection bias.

MCQ 48: Scenario: A nutritionist tests a new diet on a small group of highly motivated clients from her clinic. They all report significant weight loss.
Conclusion Drawn: "This diet works for everyone."
Which statements are true about this conclusion? Check all that apply:

- ☐ The nutritionist's conclusion is reliable and accurate.
- ☐ The conclusion is likely flawed due to a small sample size.
- ☐ The conclusion is flawed due to selection bias.

MCQ 49: Scenario: During WWII, engineers studied aircraft that returned from missions. They saw that the wings and fuselage were often full of bullet holes, but the engines and cockpit were rarely damaged.
Conclusion Drawn: "We should add more armor to the wings and fuselage."
Which statement best evaluates this conclusion?

- ☐ The conclusion is correct.
- ☐ The conclusion is flawed due to a type of selection bias known as survivorship bias.
- ☐ The engineers need a larger sample of planes to conclude anything.

D STEP 3: ANALYZING DATA

D.1 FREQUENCIES

D.1.1 DISTINGUISHING A STATISTIC FROM DATA

MCQ 50: "Su averages 14.6 points per game."
Is this statement a statistic or a single piece of data?

- ☐ A statistic
- ☐ A single piece of data

MCQ 51: "John's height is 180 cm."
Is this statement a statistic or a single piece of data?

- ☐ A statistic
- ☐ A single piece of data

MCQ 52: "The average temperature in July is 25°C."
Is this statement a statistic or a single piece of data?

- ☐ A statistic

☐ A single piece of data

MCQ 53: "Emily's favorite color is blue."
Is this statement a statistic or a single piece of data?

☐ A statistic

☐ A single piece of data

MCQ 54: "On average, students in the class scored 85%on the exam."
Is this statement a statistic or a single piece of data?

☐ A statistic

☐ A single piece of data

MCQ 55: "The median income in the city is $50,000."
Is this statement a statistic or a single piece of data?

☐ A statistic

☐ A single piece of data

D.1.2 CALCULATING RELATIVE FREQUENCIES

Ex 56: A class of 25 students was surveyed about their sex.
Complete the relative frequency column.

Sex	Frequency	Relative Frequency (%)
Girls	13	☐ %
Boys	12	☐ %
Total	25	100%

Ex 57: 40 students were asked about their favorite pet.
Complete the relative frequency column (round to 1 decimal place).

Pet	Frequency	Relative Frequency (%)
Cats	18	☐ %
Dogs	14	☐ %
Hamsters	5	☐ %
Fish	3	☐ %
Total	40	100%

Ex 58: 80 students were surveyed about their primary mode of transportation.
Complete the relative frequency column (round to 1 decimal place).

Mode of Transportation	Frequency	Relative Frequency (%)
Bus	35	☐ %
Bicycle	25	☐ %
Walking	15	☐ %
Car	5	☐ %
Total	80	100%

D.2 CENTRAL TENDENCY

D.2.1 FINDING THE MODE IN TABLES AND CHARTS

Ex 59: This frequency table shows the marks students received on a test.

Mark	Frequency
A	10
B	22
C	19
D	15
E	6

What is the mode of this dataset?

☐ A
☐ B
☐ C
☐ D
☐ E

Ex 60: This frequency table shows the primary mode of transport for a group of people.

Mode of Transport	Frequency
Bus	18
Bicycle	12
Car	8
Walking	14
Train	6

What is the mode of this dataset?

☐ Bus
☐ Bicycle
☐ Car
☐ Walking
☐ Train

Ex 61: This frequency table shows students' favorite fruits.

Fruit	Frequency
Apple	14
Banana	20
Orange	12
Grapes	10
Mango	16

What is the mode of this dataset?

☐ Apple
☐ Banana
☐ Orange
☐ Grapes
☐ Mango

Ex 62: A group of students was surveyed about their favorite music genre. The results are shown in this relative frequency table.

Music Genre	Relative Frequency (%)
Pop	45%
Rock	25%
Hip Hop	20%
Classical	10%

What is the mode of this dataset?

☐ Pop
☐ Rock
☐ Hip Hop
☐ Classical

D.2.2 CALCULATING THE MEAN

Ex 63: Over the last 5 basketball games, a player scored the following points: $15, 20, 10, 2, 5$.
Find the mean number of points scored per game.

☐ points

Ex 64: Over the last 5 days, a waiter earned the following tips: \$12, \$18, \$15, \$22, \$28.
Find the mean daily tip.

☐ dollars

Ex 65: Over the last 7 days, a student read the following number of pages each day: $30, 25, 35, 40, 20, 15, 45$.
Find the mean number of pages read per day.

☐ pages

Ex 66: For 6 days, the daily cost of lunch was: \$8, \$12, \$10, \$15, \$9, \$11.
Find the mean cost of a lunch.

\$☐

D.2.3 CALCULATING THE MEDIAN

Ex 67: A café tracked its hourly customers:

$$12, 8, 15, 10, 14, 11, 9$$

Calculate the median number of customers.

☐ customers

Ex 68: A fitness group recorded their daily exercise minutes:

$$25, 40, 30, 45, 35$$

Find the median exercise time.

☐ minutes

Ex 69: A family's savings (in \$) over 6 months were:

$$120, 80, 150, 90, 200, 110$$

Determine the median savings.

\$ ☐

Ex 70: A group of students reported the number of books they read in a month:

$$1, 3, 4, 2, 5, 3, 6, 4, 3, 2$$

Determine the median of this dataset.

☐ books

D.3 SPREAD

D.3.1 CALCULATING THE RANGE

Ex 71: The math marks (out of 20) for a group of students are:

$$4, 12, 9, 7, 11, 15, 8, 6, 14$$

Find the range of the marks.

☐

Ex 72: The average monthly temperatures (in °C) in Montréal over a year are:

$$-10, -7, 0, 7, 14, 19, 22, 21, 16, 9, 2, -5$$

Find the range of the temperatures.

☐

Ex 73: The speeds (in km/h) recorded on a highway are:

$$88.4, 91.0, 95.7, 102.3, 89.6, 100.0, 97.5, 92.1, 94.3, 90.8, 93.2, 96.6$$

Find the range of the speeds.

☐

Ex 74: The weights (in kg) of 10 packages are:

$$4.2, 3.8, 5.5, 6.1, 4.9, 3.6, 4.4, 5.2, 6.7, 3.9$$

Find the range of the weights.

☐

D.3.2 CALCULATING THE INTERQUARTILE RANGE

Ex 75: The average monthly temperatures (in °C) in Montréal over a year are:

$$-10, -7, 0, 7, 14, 19, 22, 21, 16, 9, 2, -5$$

Find the interquartile range of the temperatures.

☐

Ex 76: The speeds (in km/h) recorded for 11 cars are:

$$88, 95, 102, 91, 87, 98, 105, 93, 89, 100, 92$$

Find the interquartile range of the speeds.

☐

Ex 77: The weights (in kg) of 10 packages are:

$$4.2, 3.5, 6.1, 5.0, 4.8, 3.9, 6.7, 5.5, 4.4, 5.2$$

Find the interquartile range of the weights.

☐

Ex 78: The marks (out of 20) for 9 students are:

$$1, 19, 10, 2, 18, 11, 5, 15, 10$$

Find the interquartile range of the marks.

☐

D.3.3 CALCULATING STANDARD DEVIATION

Ex 79: Over the last 5 basketball games, a player scored: $15, 20, 10, 2, 5$.**Find the standard deviation of the scores, rounded to one decimal place.**

$\sigma \approx$ ☐ points

Ex 80: A student's marks on their last 5 exams were: $78, 85, 62, 90, 75$.**Find the standard deviation of the marks, rounded to two decimal places.**

$\sigma \approx$ ☐ marks

Ex 81: The daily temperatures (°C) in a city over 5 days were: $22, 25, 19, 30, 24$.**Find the standard deviation, rounded to two decimal places.**

$\sigma \approx$ ☐ °C

Ex 82: A small business recorded these weekly sales over 5 weeks: $\$1500, \$2000, \$1800, \$2200, \$1700$.**Find the standard deviation, rounded to the nearest dollar.**

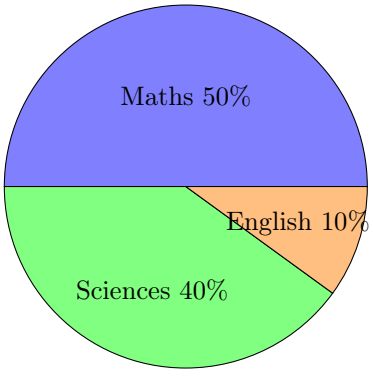
$\sigma \approx \$$ ☐

E STEP 4: REPRESENTING DATA

E.1 VISUALIZING FREQUENCIES

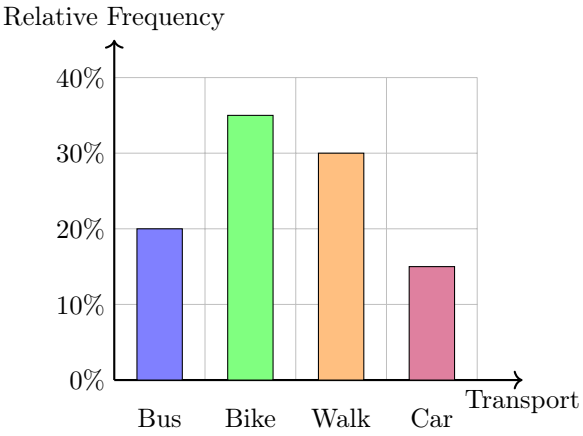
E.1.1 INTERPRETING CHARTS AND GRAPHS

Ex 83: 30 students were asked to name their favorite school subject. The results are displayed in this graph.



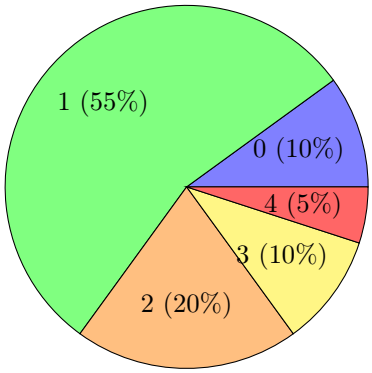
1. What type of graph is this? ☐ Bar chart ☐ Pie chart
2. Which was the most popular subject? ☐ Sciences ☐ Maths ☐ English
3. What percentage of students chose Sciences? ☐ %
4. What percentage chose either Maths or Sciences? ☐ %

Ex 84: 200 students were asked how they travel to school. The results are shown in the graph.



1. What type of graph is this? ☐ Bar chart ☐ Pie chart
2. What is the most common mode of transport? ☐ Bus ☐ Bike ☐ Walk ☐ Car
3. What percentage of students travel by bike? ☐ %
4. What percentage travel by either bus or bike? ☐ %

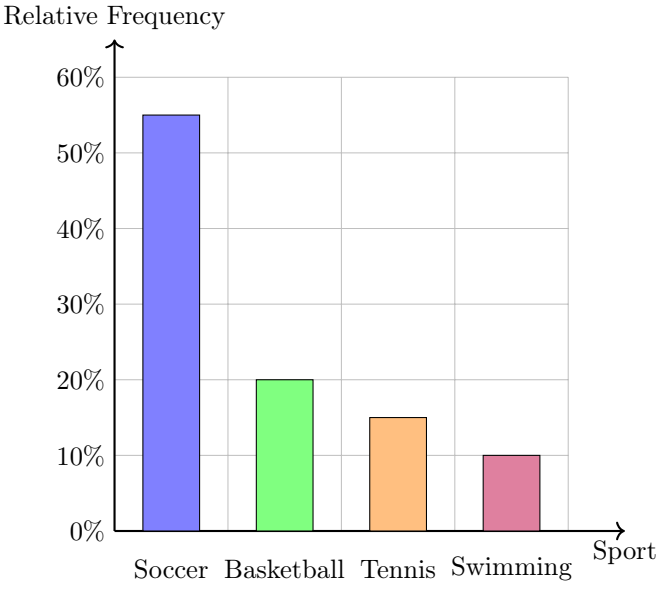
Ex 85: This pie chart shows the number of siblings for 30 students.



1. What is the mode for the number of siblings? ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4
2. What percentage of students have 2 siblings? ☐ %

3. What percentage of students have at least 1 sibling? ☐ %

Ex 86: A survey asked students to name their favorite sport. The results are in the graph.



1. Which was the most popular sport?
   - ☐ Soccer
   - ☐ Basketball
   - ☐ Tennis
   - ☐ Swimming

2. What percentage of students chose Basketball? ☐ %

3. What percentage chose either Soccer or Basketball? ☐ %

E.1.2 CONSTRUCTING STATISTICAL GRAPHS

Ex 87: **Goal:** Represent categorical data as a pie chart.
A survey asked 20 students to choose their favorite season. The results are in the table below.

Season	Frequency
Summer	10
Autumn	5
Winter	3
Spring	2
Total	**20**

First, calculate the angle for each season's slice. Then, use a protractor to draw and label a pie chart representing this data.

Ex 88: **Goal:** Represent categorical data as a bar chart.
A survey asked 25 students to choose their favorite type of movie. The results are in the table below.

Movie Genre	Frequency
Comedy	8
Action	7
Fantasy	6
Sci-Fi	4
Total	**25**

Draw and label a bar chart to represent this data. Make sure to include a title, labels for both axes, and an appropriate scale for the frequency axis.

Ex 89: **Goal:** Represent categorical data as a bar chart.
The frequency table shows the results of a survey on students' favorite after-school clubs.

Club	Frequency
Art	12
Sports	15
Music	8
Debate	5
Total	**40**

Draw and label a bar chart to represent this data. Ensure all components of the chart are included.

Ex 90: **Goal:** Represent categorical data as a pie chart.
In a survey, 50 people were asked for their favorite hot drink.

Drink	Frequency
Coffee	25
Tea	15
Hot Chocolate	10
Total	**50**

Calculate the angle for each drink's slice, then draw and label the pie chart.

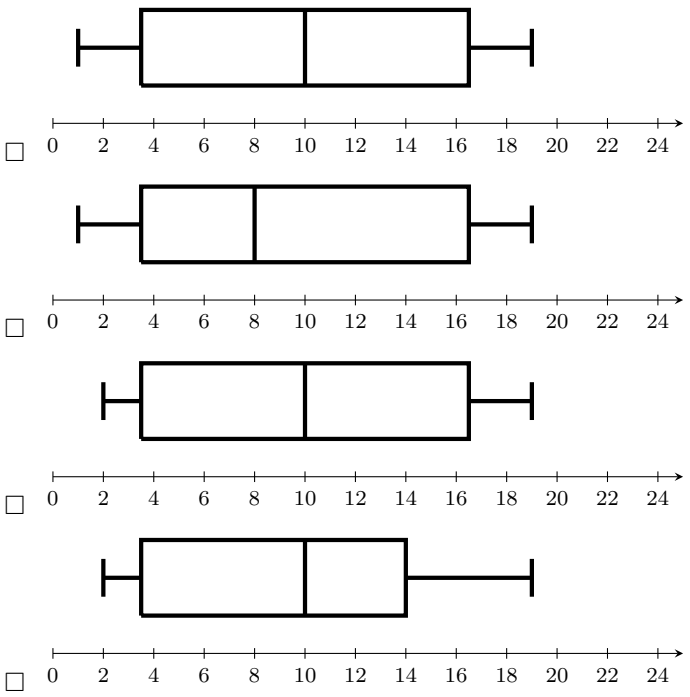
E.2 VISUALIZING CENTRAL TENDENCY AND DISPERSION

E.2.1 MATCHING A FIVE-NUMBER SUMMARY TO A BOX PLOT

MCQ 91: The five-number summary for a dataset is:

$\text{Min} = 1, \quad Q_1 = 3.5, \quad \text{Median} = 10, \quad Q_3 = 16.5, \quad \text{Max} = 19$

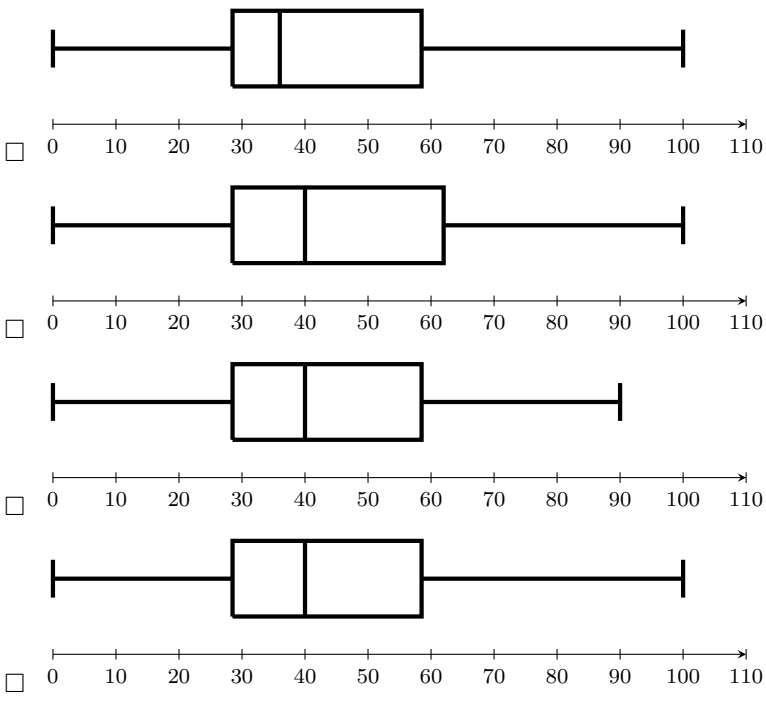
Select the correct box plot that represents this summary.



MCQ 92: The five-number summary for a dataset is:

$\text{Min} = 0, \quad Q_1 = 28.5, \quad \text{Median} = 40, \quad Q_3 = 58.5, \quad \text{Max} = 100$

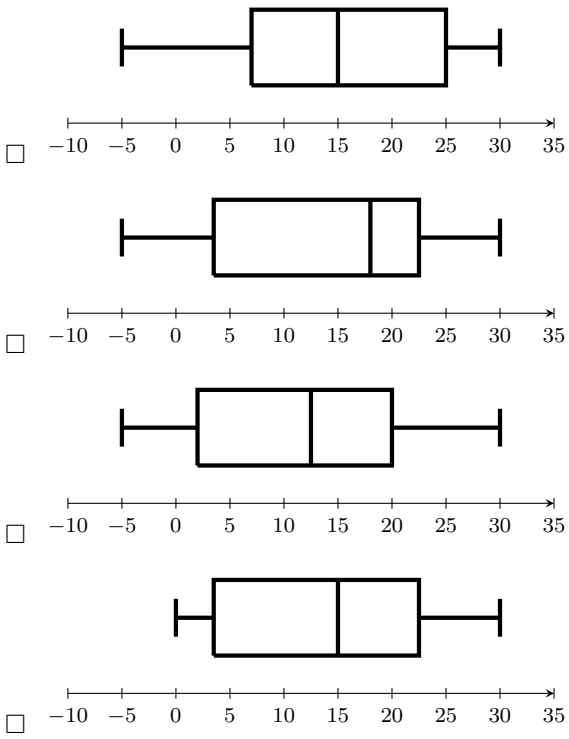
Select the correct box plot that represents this summary.



MCQ 93: The five-number summary for average monthly temperatures (°C) is:

$\text{Min} = -5, \quad Q_1 = 2, \quad \text{Median} = 12.5, \quad Q_3 = 20, \quad \text{Max} = 30$

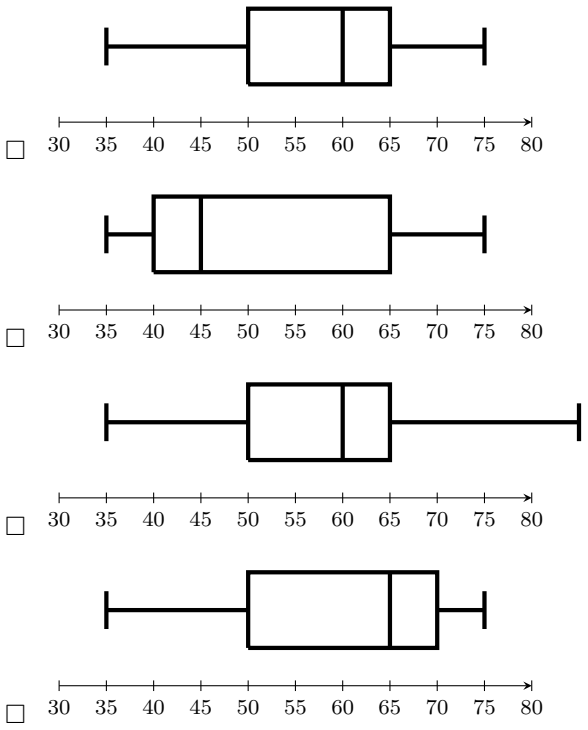
Select the correct box plot that represents this summary.



MCQ 94: The five-number summary for an air quality index (AQI) is:

$\text{Min} = 35, \quad Q_1 = 50, \quad \text{Median} = 60, \quad Q_3 = 65, \quad \text{Max} = 75$

Select the correct box plot that represents this summary.

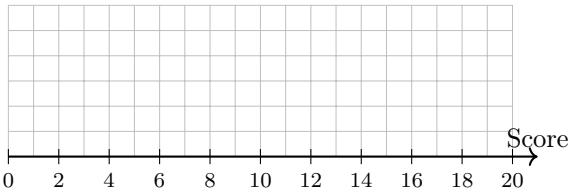


E.2.2 CONSTRUCTING BOX PLOTS

Ex 95: The five-number summary for a basketball player's scores in a season is:

$\text{Minimum} = 1, \quad Q_1 = 3, \quad \text{Median} = 10, \quad Q_3 = 16, \quad \text{Maximum} =$

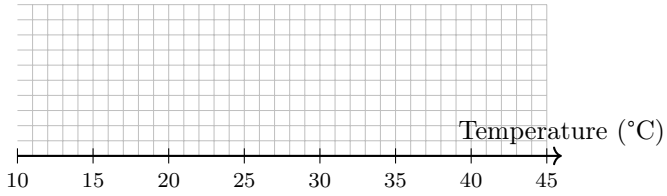
Plot the corresponding box plot on the grid below.



Ex 96: The five-number summary for yearly temperatures (°C) in Dubai is:

$\text{Minimum} = 14, \quad Q_1 = 20, \quad \text{Median} = 29, \quad Q_3 = 36, \quad \text{Maximum}$

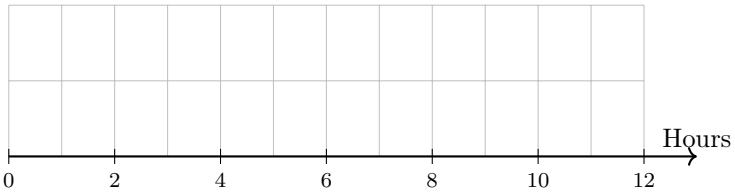
Plot the corresponding box plot on the grid below.



Ex 97: The five-number summary for hours spent reading per week is:

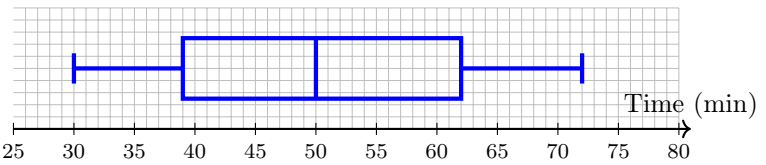
$\text{Minimum} = 1, \quad Q_1 = 3, \quad \text{Median} = 5, \quad Q_3 = 8, \quad \text{Maximum} = 1$

Plot the corresponding box plot on the grid below.



E.2.3 INTERPRETING BOX PLOTS

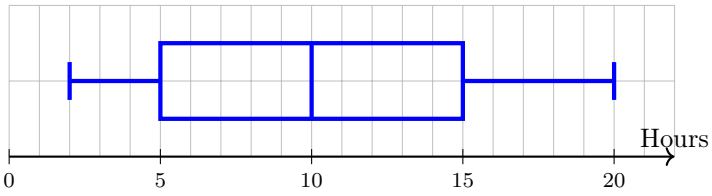
Ex 98: This box plot shows the number of minutes passengers spent waiting in an airport departure lounge.



Answer the following questions based on the box plot:

1. What is the median waiting time? ☐ minutes
2. What is the range of the waiting times? ☐ minutes
3. What is the interquartile range (IQR)? ☐ minutes
4. 75% of passengers waited longer than what amount of time? ☐ minutes

Ex 99: This box plot shows the hours students spent on an online learning platform in one week.



What is the interquartile range (IQR) of the hours spent on the platform?

☐ hours

F STEP 5: INTERPRETING DATA

F.1 DRAWING CONCLUSIONS AND EVALUATING CLAIMS

F.1.1 INTERPRETING RELATIVE FREQUENCY TABLES

MCQ 100: This table shows the relative frequency of children's favorite beverages.

Beverage	Relative Frequency (%)
Water	55%
Juice	30%
Soda	10%
Milk	5%

Based on the table, check all the true statements:

☐ Water is the most popular beverage.

☐ Milk is the least popular beverage.

☐ Soda is more popular than Juice.

☐ Milk is the most popular beverage.

☐ Water accounts for more than half of the choices.

☐ Juice and Soda combined are less popular than Water alone.

MCQ 101: This table shows how students get to school.

Transportation	Relative Frequency
Bus	15%
Walking	40%
Bicycle	30%
Car	15%

Based on the table, check all the true statements:

☐ Walking is the most popular way to get to school.

☐ Car and Bus are equally popular.

☐ Bicycle is more popular than Bus.

☐ More students take the Bus than walk.

☐ Bicycle and Walking combined account for more than half the students.

☐ Bus is one of the least popular ways to get to school.

MCQ 102: This table shows the relative frequency of students' favorite subjects.

Subject	Relative Frequency (%)
Maths	46%
Science	44%
English	10%

Based on the table, check all the true statements:

☐ Maths is the most popular subject.

☐ English is the least popular subject.

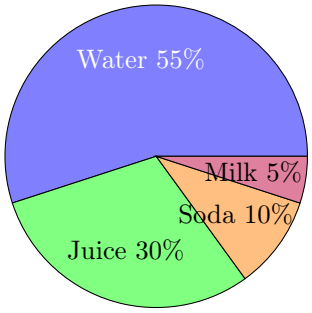
☐ Maths and Science are almost equally popular.

☐ Students get good grades in Maths.

☐ English is the most popular subject.

F.1.2 INTERPRETING VISUAL DATA

Ex 103: This pie chart shows the favorite beverages of a group of children.



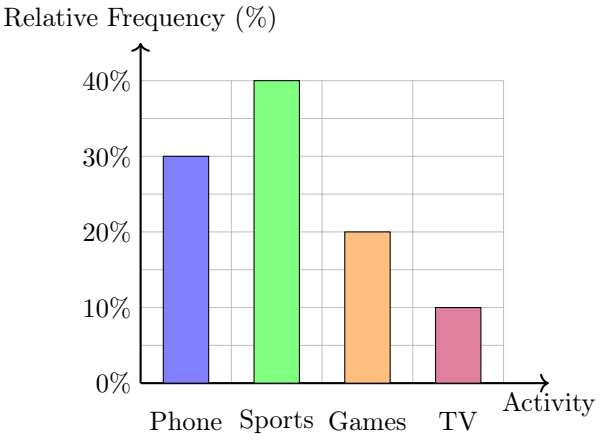
Answer these questions based on the pie chart:

1. Which beverage is the mode?
   ☐ Water
   ☐ Juice
   ☐ Soda
   ☐ Milk

2. Which beverage is the least popular?
   ☐ Water
   ☐ Juice
   ☐ Soda
   ☐ Milk

3. Is it true that more children prefer Juice than Soda?
   ☐ Yes
   ☐ No

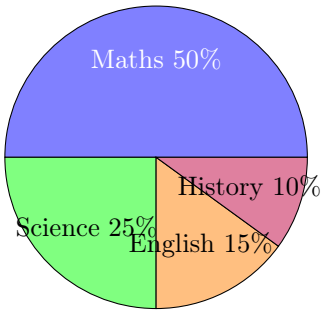
Ex 104: This bar chart shows how students spend their free time.



Answer these questions based on the bar chart:

1. What is the most popular activity (the mode)?
   - ☐ Phone
   - ☐ Sports
   - ☐ Games
   - ☐ TV
2. What is the least popular activity?
   - ☐ Phone
   - ☐ Sports
   - ☐ Games
   - ☐ TV
3. Do more students play games than use their phones?
   - ☐ Yes
   - ☐ No

Ex 105: This pie chart shows the proportion of time students spend studying different subjects.



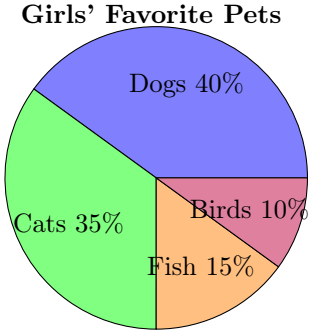
Answer these questions based on the pie chart:

1. Which subject receives the most study time?
   - ☐ Maths
   - ☐ Science
   - ☐ English
   - ☐ History
2. Which subject receives the least study time?
   - ☐ Maths
   - ☐ Science
   - ☐ English
   - ☐ History
3. Do students spend more time on English than Science?
   - ☐ Yes
   - ☐ No

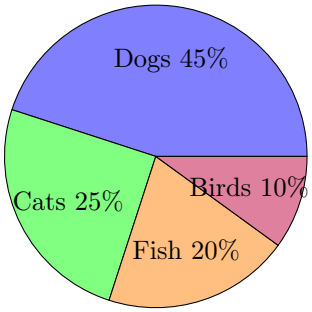
F.1.3 COMPARING DATA SETS WITH PIE CHARTS

MCQ 106: The pie charts below show the favorite pets for two different groups: Girls and Boys.

Girls' Favorite Pets



Boys' Favorite Pets

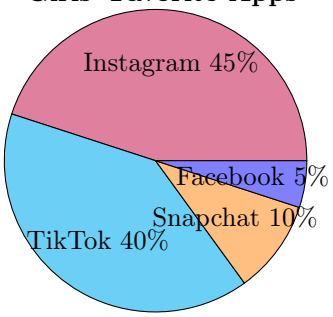


Based on a comparison of the two charts, check the true statements:

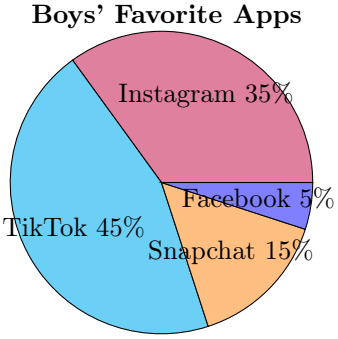
- ☐ Dogs are the most popular pet for both girls and boys.
- ☐ A higher percentage of girls like cats than boys do.
- ☐ A lower percentage of boys like fish than girls do.
- ☐ Birds are equally popular among girls and boys.

MCQ 107: These pie charts show the favorite social media apps for girls and boys.

Girls' Favorite Apps



Boys' Favorite Apps



Based on a comparison of the two charts, check the true statements:

- ☐ Instagram is the most popular app for both girls and boys.
- ☐ A higher percentage of boys like TikTok than girls do.
- ☐ A higher percentage of girls like Snapchat than boys do.
- ☐ Facebook is the least popular app for both groups.

F.1.4 MAKING COMPARISONS WITH THE MEAN

Ex 108: The mean score for girls on a math test is 87, while the mean score for boys is 75.
Based on this data, what can be concluded about the performance of girls compared to boys?

Ex 109: The mean annual salary at Company A is \$65,000, while at Company B, it is \$58,000.
Which company pays a higher salary on average?

Ex 110: The mean summer temperature in City P is 26°C, while in City Q, it is 29°C.
Which city is hotter on average during the summer?

Ex 111: The mean household income in Neighborhood A is \$82,000, while in Neighborhood B it is \$68,500.
Which neighborhood has a higher central tendency for income?

F.1.5 EVALUATING STATISTICAL CLAIMS

MCQ 112: **Scenario:** Company A reports a mean salary of \$50,000, while Company B reports a mean salary of \$55,000.
Can we conclude that the mean salary is higher in Company A?

- ☐ Yes
- ☐ No
- ☐ The data is insufficient to answer

MCQ 113: **Scenario:** In 2023, the mean temperature was 22°C. In 2024, it was 24°C.
Can we conclude that temperatures were more variable in 2024?

- ☐ Yes
- ☐ No
- ☐ The data is insufficient to answer

MCQ 114: **Scenario:** Store A and Store B both have a mean daily sale of \$1,500. Store A's sales range from \$1,000 to \$2,000. Store B's sales range from \$1,400 to \$1,600.
Were the sales more variable in Store A than in Store B?

- ☐ Yes
- ☐ No
- ☐ The data is insufficient to answer

MCQ 115: **Scenario:** In a study, the mean height of girls was 160 cm, and the mean height of boys was 162 cm.
Are girls taller than boys on average?

- ☐ Yes
- ☐ No
- ☐ The data is insufficient to answer

F.1.6 INTERPRETING AND COMPARING STATISTICAL MEASURES

Ex 116: In Country X, the interquartile range (IQR) of salaries was \$20,000 in 2022 and \$25,000 in 2023. Does this indicate greater salary inequality in 2023?

Ex 117: Two schools had the same mean score of 14/20 on a math exam. However, School A had an IQR of 4, while School B had an IQR of 7.
Which school had more variability in its student results?

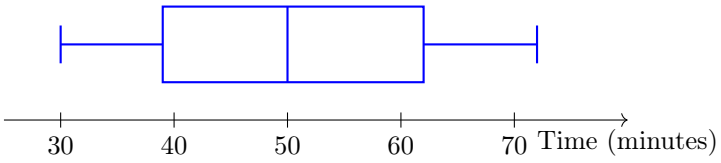
Ex 118: In City X, the mean income is \$40,000 with an IQR of \$10,000. In City Y, the mean income is \$45,000 with an IQR of \$18,000.
Which city shows more income disparity?

Ex 119: Investment A has a mean annual return of \$5,000 with an IQR of \$2,000. Investment B has a mean annual return of \$6,000 with an IQR of \$4,000.
If you are only seeking the highest average return, which investment is more attractive?

Ex 120: Using the same data as the previous question: Investment A has a mean return of \$5,000 (IQR \$2,000), and Investment B has a mean return of \$6,000 (IQR \$4,000).
If you prefer a safer, more predictable investment, which one should you choose?

F.1.7 INTERPRETING BOX PLOTS IN CONTEXT

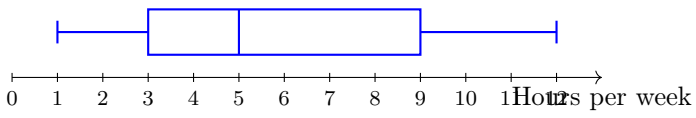
MCQ 121: **Scenario:** This box plot shows the number of minutes passengers spent waiting in an airport lounge.



Evaluate the following statements. Check all that are true.

- ☐ "Half the passengers wait more than 50 minutes."
- ☐ "25% of passengers wait more than 62 minutes."
- ☐ "The shortest wait time was 72 minutes."

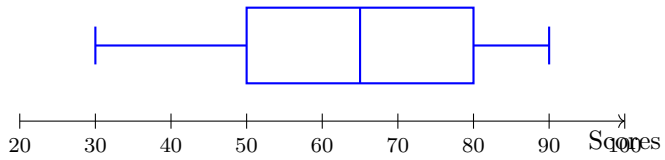
MCQ 122: **Scenario:** This box plot shows the hours per week students in a music school practice their instrument.



Evaluate the following statements. Check all that are true.

- ☐ "The middle 50% of students practice between 3 and 9 hours per week."
- ☐ "Every student practices at least 3 hours per week."
- ☐ "75% of students practice 9 hours or less per week."

MCQ 123: **Scenario:** This box plot shows students' scores on a reading test (out of 100).

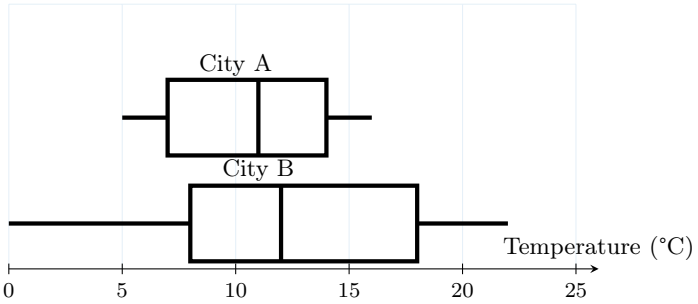


Evaluate the following statements. Check all that are true.

- ☐ "Half the students scored 65 or higher."
- ☐ "25% of students scored below 50, which might indicate they need extra reading help."
- ☐ "The lowest score was 90."

F.1.8 COMPARING DISTRIBUTIONS WITH BOX PLOTS

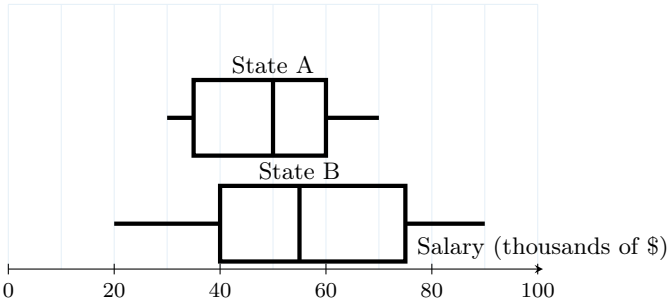
MCQ 124: **Scenario:** These box plots show the daily temperatures (°C) in City A and City B over a year.



Based on the plots, check the true statements.

- ☐ "City B's temperatures are more spread out than City A's."
- ☐ "City A has colder minimum temperatures than City B."

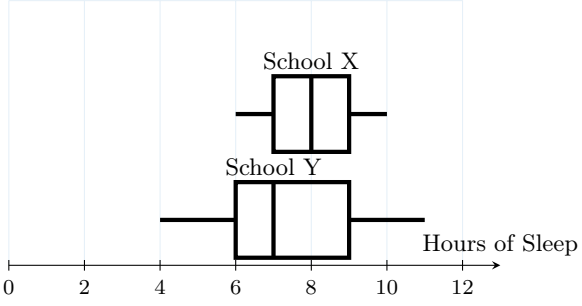
MCQ 125: **Scenario:** These box plots show yearly salaries (in thousands of \$) in State A and State B.



Based on the plots, check the true statements.

- ☐ "The range of salaries in State A is wider than in State B."
- ☐ "The median salary in State B is higher than in State A."
- ☐ "State B has greater income inequality than State A."

MCQ 126: **Scenario:** These box plots show the hours of sleep per night for teens in School X and School Y.



Based on the plots, check the true statements.

- ☐ "The sleep hours for teens in School X are more consistent than in School Y."
- ☐ "The median teen in School X gets more sleep than the median teen in School Y."

F.1.9 INTERPRETING AVERAGES VS. ABSOLUTE STATEMENTS

Ex 127: Claim: "The average science score is higher for Class 1 than for Class 2. Therefore, every student in Class 1 is better at science than every student in Class 2."
Evaluate this statement and explain whether the conclusion is statistically valid.

Ex 128: Claim: "The slowest runner in Team A was faster than the fastest runner in Team B. Therefore, every runner in Team A is faster than every runner in Team B."
Evaluate this statement and explain whether the conclusion is statistically valid.

Ex 129: Claim: "The average score in the piano competition was higher for participants from School X than from School Y. Therefore, every pianist from School X played better than every pianist from School Y."
Evaluate this statement and explain whether the conclusion is statistically valid.

Ex 130: Claim: "The tallest player on Team Red is shorter than the shortest player on Team Blue. Therefore, every player on Team Blue is taller than every player on Team Red."
Evaluate this statement and explain whether the conclusion is statistically valid.