STATISTICS

A STATISTICAL INVESTIGATION

A.1 A STEP-BY-STEP INVESTIGATION

A.1.1 IDENTIFYING THE STEPS

MCQ 1: The girls' average score in math is 87 (B+), while the boys' average is 75 (C). since 87 > 75, on average, girls perform better than boys in math.
Which step does this sentence refer to?

- ☐ Step 1: State the Problem
- ☐ Step 2: Collect Data
- ☐ Step 3: Calculate Descriptive Statistics
- ☐ Step 4: Organize and Display Data
- ☒ Step 5: Interpret the Statistics

Answer: Step 5: Interpret the Statistics. This sentence draws a conclusion about what the data means, comparing girls' and boys' preferences based on calculated averages.

MCQ 2: "Do students prefer science over math?"
Which step does this sentence refer to?

- ☒ Step 1: State the Problem
- ☐ Step 2: Collect Data
- ☐ Step 3: Calculate Descriptive Statistics
- ☐ Step 4: Organize and Display Data
- ☐ Step 5: Interpret the Statistics

Answer: Step 1: State the Problem. This sentence asks a question to figure out what we want to learn, setting up the investigation.
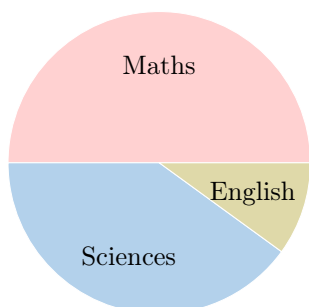
MCQ 3: "We asked every student in the school to fill out a survey about their favorite subjects."
Which step does this sentence refer to?

- ☐ Step 1: State the Problem
- ☒ Step 2: Collect Data
- ☐ Step 3: Calculate Descriptive Statistics
- ☐ Step 4: Organize and Display Data
- ☐ Step 5: Interpret the Statistics

Answer: Step 2: Collect Data. This sentence describes gathering the information needed for the investigation.

MCQ 4: "We made a pie chart showing how many students chose each subject."

Which step does this sentence refer to?

- ☐ Step 1: State the Problem
- ☐ Step 2: Collect Data
- ☐ Step 3: Calculate Descriptive Statistics
- ☒ Step 4: Organize and Display Data
- ☐ Step 5: Interpret the Statistics

Answer: Step 4: Organize and Display Data. This sentence describes creating a visual representation of the data.

MCQ 5: "The relative frequency of students choosing 'Math' as their favorite subject is 50%."
Which step does this sentence refer to?

- ☐ Step 1: State the Problem
- ☐ Step 2: Collect Data
- ☒ Step 3: Calculate Descriptive Statistics
- ☐ Step 4: Organize and Display Data
- ☐ Step 5: Interpret the Statistics

Answer: Step 3: Calculate Descriptive Statistics. This sentence uses relative frequency to summarize the data collected, showing what portion of students picked 'Math' as their favorite.

B STATING THE PROBLEM

B.1 POPULATION

B.1.1 FINDING POPULATIONS

MCQ 6: You're studying how long kids play outside each day. Your question is: **"How many hours do kids spend playing outside each day?"**
Which population is best to study?
Check the correct answer:

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

Answer:

- "All adults in a city." **False** – The question is about kids, not adults.
- "All kids in a school." **True** – The question is about kids, and a school has kids to study.
- "All dogs in a neighborhood." **False** – Dogs aren't kids and don't play like them.
- "All teachers in a country." **False** – Teachers are adults, not kids.

MCQ 7: You're studying pets in homes. Your question is: **"How many families own a pet in our town?"** Which population is best to study?

Check the correct answer:

☐ "All kids in a playground."

☐ "All birds in a forest."

☐ "All workers in a factory."

☒ "All families in our town."

Answer:

- "All kids in a playground." **False** – The question is about families, not kids.

- "All birds in a forest." **False** – Birds aren't families or pets.

- "All workers in a factory." **False** – Workers aren't families.

- "All families in our town." **True** – The question is about families, and this population fits.

MCQ 8: You're studying reading habits. Your question is: **"How many books do students borrow from the school library each month?"** Which population is best to study?

Check the correct answer:

☐ "All librarians in a state."

☒ "All students in a school."

☐ "All books in a bookstore."

☐ "All parents in a neighborhood."

Answer:

- "All librarians in a state." **False** – The question is about students, not librarians.

- "All students in a school." **True** – The question is about students, and a school has students to study.

- "All books in a bookstore." **False** – Books don't borrow; the question is about students.

- "All parents in a neighborhood." **False** – Parents aren't students.

MCQ 9: You're studying nature. Your question is: **"How tall are the oak trees in a national park?"** Which population is best to study?

Check the correct answer:

☒ "All oak trees in a national park."

☐ "All rivers in a country."

☐ "All clouds in the sky."

☐ "All rocks on a mountain."

Answer:

- "All oak trees in a national park." **True** – The question is about oak trees, and this population fits.

- "All rivers in a country." **False** – The question is about oak trees, not rivers.

- "All clouds in the sky." **False** – Clouds aren't trees.

- "All rocks on a mountain." **False** – Rocks aren't trees.

B.2.1 SORTING DATA TYPES

MCQ 10: What type of data is: favorite subject (e.g., Maths, Science, English)?

☐ Quantitative variable

☒ Qualitative variable

Answer: Qualitative variable. "Favorite subject" groups subjects like Maths or Science—it's not a number.

MCQ 11: What type of data is: number of siblings?

☒ Quantitative variable

☐ Qualitative variable

Answer: Quantitative variable. "Number of siblings" is a number you count, like 1 or 2.

MCQ 12: What type of data is: type of vehicle (e.g., car, bicycle, bus)?

☐ Quantitative variable

☒ Qualitative variable

Answer: Qualitative variable. "Type of vehicle" groups vehicles like car or bus—it's not a number.

MCQ 13: What type of data is: height of students (in cm)?

☒ Quantitative variable

☐ Qualitative variable

Answer: Quantitative variable. "Height of students" is a number you measure, like 150 cm.

MCQ 14: What type of data is: level of education (e.g., high school, bachelor's, master's)?

☐ Quantitative variable

☒ Qualitative variable

Answer: Qualitative variable. "Level of education" groups levels like high school—it's not a number.

MCQ 15: What type of data is: annual income (in dollars)?

☒ Quantitative variable

☐ Qualitative variable

Answer: Quantitative variable. "Annual income" is a number you measure, like 30,000 dollars.

C COLLECTING DATA

C.1 SAMPLING

C.1.1 WRITING A SURVEY QUESTION

Ex 16: Write a survey question about music that would enable you to collect numerical data.

Answer: A good survey question about music should ask for a number in a clear way, so you can collect numerical data. An example like "How many hours do you listen to music each day?" is a good question because it asks students for a number of hours, like 1 or 2, which you can count or measure. Other good examples could be "How many songs do you listen to each week?" or "How many times do you play music each day?" These questions help you gather numerical data about music in a way that Grade 5 students can answer easily.

Ex 17: Write a survey question about music that would enable you to collect categorical data.

Answer: A good survey question about music should ask for a category in a clear way, so you can collect categorical data. An example like "What type of music do you like best?" is a good question because it asks students to pick a category, like pop or rock, which you can group and count. Other good examples could be "What is your favorite music band?" or "Which music app do you use most?" These questions help you gather categorical data about music in a way that Grade 5 students can answer easily.

Ex 18: Write a survey question about food that would enable you to collect categorical data.

Answer: A good survey question about food should ask for a category in a clear way, so you can collect categorical data. An example like "What type of food do you like best?" is a good question because it asks students to pick a category, like pizza or salad, which you can group and count. Other good examples could be "What is your favorite dessert?" or "Which meal do you like most?" These questions help you gather categorical data about food in a way that Grade 5 students can answer easily.

Ex 19: Write a survey question about food that would enable you to collect numerical data.

Answer: A good survey question about food should ask for a number in a clear way, so you can collect numerical data. An example like "How many times do you eat snacks each day?" is a good question because it asks students for a number of times, like 1 or 2, which you can count or measure. Other good examples could be "How many fruits do you eat each week?" or "How many meals do you have each day?" These questions help you gather numerical data about food in a way that Grade 5 students can answer easily.

C.1.2 CHOOSING CENSUS OR SURVEY

MCQ 20: You need to elect the Grade 7 class representative. What method should you use?

☐ Survey

☒ Census

Answer: Census. To ensure a fair election, you ask every student in the class to vote, not just a sample.

MCQ 21: You want to find out how much soda Grade 7 students drink in the entire country. What method should you use?

☒ Survey

☐ Census

Answer: Survey. It would be too difficult and costly to ask every Grade 7 student in the country, so you collect data from a representative sample.

MCQ 22: Your teacher wants to know exactly how many students in your class have a pet. What method should be used?

☐ Survey

☒ Census

Answer: Census. The teacher can simply ask every student in the class.

MCQ 23: Researchers want to estimate the average number of hours Grade 7 students sleep per night in a large city. What method should they use?

☒ Survey

☐ Census

Answer: Survey. It's more practical to gather information from a sample of students than to ask every single one in a large city.

MCQ 24: You want to find out the most popular after-school snack among Grade 7 students in your entire country. What method should you use?

☒ Survey

☐ Census

Answer: Survey. It's not realistic to ask every student in the country, so you collect answers from a sample.

C.1.3 COMPLETING FREQUENCY TABLES

Ex 25: The class took the temperature at lunchtime for 20 days:

$19°C, 18°C, 19°C, 20°C, 19°C, 20°C, 20°C, 20°C,$
$19°C, 18°C, 20°C, 19°C, 20°C, 19°C, 18°C, 20°C,$
$18°C, 17°C, 19°C, 20°C$

Complete the table to show how many times each temperature happened:

Temperature (°C)	Frequency
17	1
18	4
19	7
20	8

Answer: To find the frequency, count how many times each temperature appears in the list:

- 17°C: 1 time (day 18).

- 18°C: 4 times (days 2, 10, 15, 17).

- 19°C: 7 times (days 1, 3, 5, 9, 12, 14, 19).

- 20°C: 8 times (days 4, 6, 7, 8, 11, 13, 16, 20).

Ex 26: The class recorded the number of siblings for 20 students:

$$1, 2, 1, 0, 1, 2, 2, 3, 1, 0,$$
$$2, 1, 3, 1, 0, 2, 1, 0, 2, 1$$

Complete the table to show how many times each number of siblings happened:

Number of Siblings	Frequency
0	4
1	8
2	6
3	2

Answer: To find the frequency, count how many times each number of siblings appears in the list:

- 0 siblings: 4 times (students 4, 10, 15, 18).

- 1 sibling: 8 times (students 1, 3, 5, 9, 12, 14, 17, 20).

- 2 siblings: 6 times (students 2, 6, 7, 11, 16, 19).

- 3 siblings: 2 times (students 8, 13).

Ex 27: Count the vowels (a, e, i, o, u) in this sentence: "I love Mathematics. It is so fun to solve problems and discover cool patterns."

Complete the table:

Vowel	a	e	i	o	u
Frequency	4	5	5	5	2

Answer: Count each vowel in "I love Mathematics. It is so fun to solve problems and discover cool patterns." (ignore spaces and punctuation):
- a: 4 times (in "Mathematics," "Mathematics," "and," "patterns").
- e: 5 times (in "love," "Mathematics," "solve," "problems," "discover").
- i: 5 times (in "I," "Mathematics," "It," "is," "discover").
- o: 5 times (in "love," "to," "so," "solve," "cool").
- u: 2 times (in "fun," "discover").

C.2 STATISTICAL ERROR IN SAMPLING

C.2.1 SPOTTING STATISTICAL ERRORS

MCQ 28: A teacher wants to gauge how students feel about his lessons. He surveys the 5 students in the front row and concludes that all his students enjoy his teaching.
Which statements are true? Check all that apply:

☐ The teacher's conclusion is reliable and accurate.

☒ The teacher's conclusion is flawed due to a small sample size.

☒ The teacher's conclusion is flawed due to selection bias.

Answer: The teacher's conclusion is flawed.

- **Small sample size:** Surveying only 5 students is not enough to represent the whole class.

- **Selection bias:** Front-row students may be more engaged and positive than the rest.

MCQ 29: A marketing manager wants to test if a new product will appeal to the public. He surveys employees who developed the product and concludes it will succeed with all consumers.
Which statements are true? Check all that apply:

☐ The manager's conclusion is reliable and accurate.

☐ The manager's conclusion is flawed due to a small sample size.

☒ The manager's conclusion is flawed due to selection bias.

Answer: The manager's conclusion is flawed.

- **Selection bias:** The employees are not representative of all consumers—they are likely to be more positive because they worked on the product.

MCQ 30: A city planner wants to gauge opinions on a new park. She surveys a large, diverse, random group of residents from various neighborhoods and ages, concluding most support the park.
Which statements are true? Check all that apply:

☒ 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.

Answer: The planner's conclusion is likely reliable.

- **Good sampling:** A large, random, and diverse sample minimizes bias and is likely to represent the population.

MCQ 31: A nutritionist tests a new diet's effectiveness by selecting clients from her clinic. After a month, they report significant weight loss, and she concludes the diet works for everyone.
Which statements are true? Check all that apply:

☐ The nutritionist's conclusion is reliable and accurate.

☐ The nutritionist's conclusion is flawed due to a small sample size.

☒ The nutritionist's conclusion is flawed due to selection bias.

Answer: The nutritionist's conclusion is flawed.

- **Selection bias:** Clinic clients are already motivated about their health, so they may not represent the wider population.

MCQ 32: During World War II, Allied engineers studied returning aircraft to decide where to add armor. They noted frequent damage to wings and fuselage, but little to engines and cockpits, concluding wings and fuselage needed more armor.
Which statement is true? Check the correct one:

☐ The engineers' conclusion is correct; wings and fuselage need more armor.

☒ The engineers' conclusion is flawed due to selection bias; engines and cockpits need more armor.

☐ The engineers lack enough data to conclude anything.

Answer: The engineers' conclusion is flawed due to selection bias.

- **Survivorship bias:** They only studied planes that survived. Damage to wings/fuselage did not down the planes, but engine or cockpit hits were fatal and not observed.

MCQ 33: In a small town, a neighborhood shows a cluster of cancer cases, and residents blame a nearby factory. Yet, the town's overall cancer rate matches the national average.
Which statement is true? Check the correct one:

☐ The factory definitely caused the cancer cluster.

☒ The cluster might be random, and more investigation is needed.

☐ The town's average cancer rate proves the factory isn't to blame.

Answer: The cluster might be random, and more investigation is needed.

- **Clustering fallacy:** Disease cases can group by chance. Blaming the factory without further evidence is premature—more data is needed.

MCQ 34: In a factory experiment to boost productivity, researchers increased the lighting and noticed workers produced more. Later, they dimmed the lights back to normal, but productivity stayed high.
Which statement best explains this? Check the correct one:

☐ Brighter lighting directly caused the productivity boost.

☒ Workers performed better because they knew they were being studied.

☐ Productivity improved when the original lighting returned.

Answer: The correct answer is: "Workers performed better because they knew they were being studied."

- **Hawthorne Effect:** The change in productivity was due to workers' awareness of being observed, not the lighting change itself.

D DESCRIPTIVE STATISTICS

D.1 A STATISTIC

D.1.1 SPOTTING STATISTICS

MCQ 35: "Su averages 14.6 points per game."
Is this an example of statistics?

☒ Yes

☐ No

Answer: Yes, "Su averages 14.6 points per game" is an example of statistics. It's a number that sums up how Su has performed across multiple games, not just one.

MCQ 36: "John's height is 180 cm."
Is this an example of statistics?

☐ Yes

☒ No

Answer: No, "John's height is 180 cm" is not statistics. It's just one measurement about one person, not a summary of many measurements.

MCQ 37: "The average temperature in July is 25°C."
Is this an example of statistics?

☒ Yes

☐ No

Answer: Yes, "The average temperature in July is 25°C" is statistics. It combines temperature data from many days into one number.

MCQ 38: "Emily's favorite color is blue."
Is this an example of statistics?

☐ Yes

☒ No

Answer: No, "Emily's favorite color is blue" is not statistics. It's just one person's preference, not a summary of data from a group.

MCQ 39: "On average, students in the class scored 85% on the exam."
Is this an example of statistics?

☒ Yes

☐ No

Answer: Yes, "On average, students in the class scored 85% on the exam" is statistics. It sums up how the whole class did on the exam in one number.

MCQ 40: "The median income in the city is $ 50,000."
Is this an example of statistics?

☒ Yes

☐ No

Answer: Yes, "The median income in the city is $ 50,000" is statistics. It's a number that summarizes the incomes of many people in the city.

D.2 RELATIVE FREQUENCY

D.2.1 CALCULATING RELATIVE FREQUENCIES WITH 2 CATEGORIES

Ex 41: A class of 25 students was surveyed about their gender. Compute the percentages (rounded to one decimal place):

Gender	Frequency	Relative Frequency (%)
Girls	13	52 %
Boys	12	48 %
Total	25	100%

Answer: Here's how to calculate each percentage:

Gender	Frequency	Relative Frequency (%)
Girls	13	$\frac{13}{25} \times 100\% = 52\%$
Boys	12	$\frac{12}{25} \times 100\% = 48\%$
Total	25	100%

The percentage of girls is 52% and the percentage of boys is 48%.

Ex 42: A class of 25 students took a quiz, and their results were recorded. Compute the percentages (rounded to one decimal place):

Result	Frequency	Relative Frequency (%)
Pass	15	60 %
Fail	10	40 %
Total	25	100%

Answer: Here's how to calculate each percentage:

Result	Frequency	Relative Frequency (%)
Pass	15	$\frac{15}{25} \times 100\% = 60\%$
Fail	10	$\frac{10}{25} \times 100\% = 40\%$
Total	25	100%

The percentage of students who passed is 60%, and the percentage who failed is 40%.

Ex 43: A basketball player attempted 50 shots during practice. Compute the shooting percentages (rounded to one decimal place):

Outcome	Frequency	Relative Frequency (%)
Success	32	64 %
Miss	18	36 %
Total	50	100%

Answer:

Outcome	Frequency	Relative Frequency (%)
Success	32	$\frac{32}{50} \times 100\% = 64\%$
Miss	18	$\frac{18}{50} \times 100\% = 36\%$
Total	50	100%

The success rate is 64%.

Ex 44: A company tested 70 new light bulbs to see if they would last over 1,000 hours. Compute the success percentages (rounded to one decimal place):

Outcome	Frequency	Relative Frequency (%)
Success	49	70 %
Miss	21	30 %
Total	70	100%

Answer:

Outcome	Frequency	Relative Frequency (%)
Success	49	$\frac{49}{70} \times 100\% = 70\%$
Miss	21	$\frac{21}{70} \times 100\% = 30\%$
Total	70	100%

The success rate is 70%.

D.2.2 CALCULATING RELATIVE FREQUENCIES

Ex 45: In a middle school, students were asked what their favorite animal was. Fill in the relative frequencies (round to 1 decimal place):

Pet	Frequency	Relative Frequency (%)
Cats	18	45 %
Dogs	14	35 %
Hamsters	5	12.5 %
Fish	3	7.5 %
Total	40	100%

Answer: Here's how to calculate each relative frequency:

Pet	Frequency	Relative Frequency (%)
Cats	18	$\frac{18}{40} \times 100\% = 45\%$
Dogs	14	$\frac{14}{40} \times 100\% = 35\%$
Hamsters	5	$\frac{5}{40} \times 100\% = 12.5\%$
Fish	3	$\frac{3}{40} \times 100\% = 7.5\%$
Total	40	100%

Ex 46: A group of 50 students chose their favorite fruit. Fill in the relative frequencies (round to 1 decimal place):

Fruit	Frequency	Relative Frequency (%)
Apples	20	40 %
Bananas	15	30 %
Cherries	10	20 %
Grapes	5	10 %
Total	50	100%

Answer: Here's how to calculate each relative frequency:

Fruit	Frequency	Relative Frequency (%)
Apples	20	$\frac{20}{50} \times 100\% = 40\%$
Bananas	15	$\frac{15}{50} \times 100\% = 30\%$
Cherries	10	$\frac{10}{50} \times 100\% = 20\%$
Grapes	5	$\frac{5}{50} \times 100\% = 10\%$
Total	50	100%

Ex 47: In a middle school, students were asked what their favorite means of transportation was. Fill in the relative frequencies (round to 1 decimal place):

Mode of Transportation	Frequency	Relative Frequency (%)
Bus	35	43.8 %
Bicycle	25	31.3 %
Walking	15	18.8 %
Car	5	6.3 %
Total	80	100%

Answer: Here's how to calculate each relative frequency:

Mode of Transportation	Frequency	Relative Frequency (%)
Bus	35	$\frac{35}{80} \times 100\% \approx 43.8\%$
Bicycle	25	$\frac{25}{80} \times 100\% \approx 31.3\%$
Walking	15	$\frac{15}{80} \times 100\% \approx 18.8\%$
Car	5	$\frac{5}{80} \times 100\% \approx 6.3\%$
Total	80	100%

Ex 48: 🖩 In a middle school, students were asked what their favorite music genre was. Fill in the relative frequencies (round to 1 decimal place):

Type of Music	Frequency	Relative Frequency (%)
Pop	40	40 %
Rock	30	30 %
Classical	20	20 %
Jazz	10	10 %
Total	100	100%

Answer: Here's how to calculate each relative frequency:

Type of Music	Frequency	Relative Frequency (%)
Pop	40	$\frac{40}{100} \times 100\% = 40\%$
Rock	30	$\frac{30}{100} \times 100\% = 30\%$
Classical	20	$\frac{20}{100} \times 100\% = 20\%$
Jazz	10	$\frac{10}{100} \times 100\% = 10\%$
Total	100	100%

D.3 CENTRAL TENDENCY

D.3.1 FINDING THE MODE

Ex 49: Look at this frequency table showing marks:

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

What's the mode?

$$\boxed{\text{B}} \text{ mark}$$

Answer: The mode is B because it has the highest frequency (22).

Ex 50: Check this frequency table for modes of transport:

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

What's the mode?

$$\boxed{\textbf{Bus}}$$

Answer: The mode is Bus because it has the highest frequency (18).

Ex 51: Look at this frequency table showing favorite fruits:

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

What's the mode?

$$\boxed{\textbf{Banana}} \text{ fruit}$$

Answer: The mode is Banana because it has the highest frequency (20).

Ex 52: 30 students were asked how many siblings they have, and the results are shown in this pie chart:
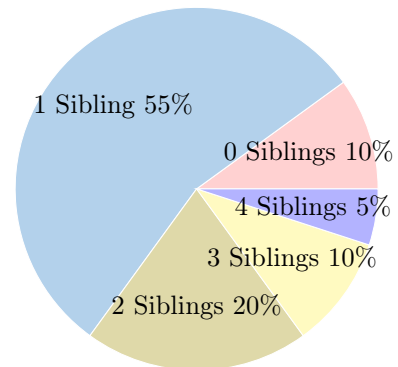
What's the mode?

$$\boxed{\textbf{1 Sibling}}$$

Answer: The mode is 1 Sibling because it's the most common, with 55% .

D.3.2 CALCULATING A MEAN

Ex 53: 🖩 Over the last 5 basketball games, I scored these points: 15, 20, 10, 2, and 5.
Find the mean score:

$$\boxed{10.4} \text{ points}$$

Answer: Here's how to find the mean:

$$\text{mean} = \frac{\text{sum of all points}}{\text{number of games}}$$
$$= \frac{15 + 20 + 10 + 2 + 5}{5}$$
$$= 10.4$$

Ex 54: 🖩 Over the last 5 days, I earned these tips as a waiter: 12, 18, 15, 22, and 28.
Find the mean tip:

$$\boxed{19} \text{ dollars}$$

Answer: Here's how to find the mean:

$$\text{mean} = \frac{\text{sum of all tips}}{\text{number of days}}$$
$$= \frac{12 + 18 + 15 + 22 + 28}{5}$$
$$= 19$$

Ex 55: 🖩 Over the last 7 days, I read these numbers of pages: 30, 25, 35, 40, 20, 15, and 45.
Find the mean number of pages:

$$\boxed{30} \text{ pages}$$

Answer: Here's how to find the mean:

$$\text{mean} = \frac{\text{sum of all pages}}{\text{number of days}}$$
$$= \frac{30 + 25 + 35 + 40 + 20 + 15 + 45}{7}$$
$$= 30$$

Ex 56: ⌨ Over the last 6 days, I spent these amounts on lunch: 8, 12, 10, 15, 9, and 11.
Find the mean cost:

$$\boxed{10.8} \text{ dollars}$$

Answer: Here's how to find the mean:

$$\text{mean} = \frac{\text{sum of all costs}}{\text{number of days}}$$
$$= \frac{8 + 12 + 10 + 15 + 9 + 11}{6}$$
$$= 10.8$$

D.3.3 CALCULATING A MEDIAN

Ex 57: A café tracked hourly customers:

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

Calculate the median number of customers.

$$\boxed{11}$$

Answer: Order the data:

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

There are 7 values (odd), so the median is the 4th term: 11 customers.

Ex 58: A fitness group recorded their daily exercise minutes (Monday–Friday):

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

Find the median exercise time.

$$\boxed{35}$$

Answer: Order the data:

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

There are 5 values (odd), so the median is the 3rd term: 35 minutes.

Ex 59: Family savings (in $) over 6 months:

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

Determine the median savings.

$$\boxed{115}$$

Answer: Order the data:

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

There are 6 values (even), so the median is the average of the 3rd and 4th terms:

$$\frac{110 + 120}{2} = 115$$

Ex 60: A group of students reported the number of books they read in a month as follows:

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

Determine the median of this dataset.

$$\boxed{3}$$

Answer: First, arrange the data in ascending order:

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

There are 10 values (even), so the median is the average of the 5th and 6th terms:

$$\frac{3 + 3}{2} = 3$$

So, the median is 3.

D.4 DISPERSION

D.4.1 CALCULATING A RANGE

Ex 61: ⌨ The following data shows the math marks (out of 20) obtained by a group of students:

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

Find the range of the marks.

$$\boxed{11}$$

Answer:

- The minimum mark is 4.
- The maximum mark is 15.
- The range is: $15 - 4 = 11$.

Ex 62: ⌨ The following data shows the average monthly temperatures (in °C) in Montréal over a year:

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

Find the **range** of temperatures.

$$\boxed{32}$$

Answer:

- The minimum temperature is -10°C.
- The maximum temperature is 22°C.
- The range is: $22 - (-10) = 32$°C.

Ex 63: The following data shows the speeds (in km/h) recorded by a radar on a highway during 12 different times of the day:

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.

$$\boxed{13.9}$$

Answer:

- The minimum speed is 88.4 km/h.

- The maximum speed is 102.3 km/h.

- The range is: $102.3 - 88.4 = 13.9$ km/h.

Ex 64: The following data shows the weights (in kg) of 10 packages stored in a warehouse:

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.

$$\boxed{3.1}$$

Answer:

- The minimum weight is 3.6 kg.

- The maximum weight is 6.7 kg.

- The range is: $6.7 - 3.6 = 3.1$ kg.

D.4.2 CALCULATING AN INTERQUARTILE RANGE

Ex 65: The following data shows the average monthly temperatures (in °C) in Montréal over a year:

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

Find the **interquartile range** of the temperatures.

$$\boxed{24}$$

Answer:

- Order the data:

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

- Median (Q_2) is average of 6th and 7th values: $\frac{7+9}{2} = 8$

- Lower half: $-10, -7, -5, 0, 2, 7$
  Q_1 is average of 3rd and 4th: $\frac{-5+0}{2} = -2.5$

- Upper half: $9, 14, 16, 19, 21, 22$
  Q_3 is average of 3rd and 4th: $\frac{16+19}{2} = 17.5$

- Interquartile range: $Q_3 - Q_1 = 17.5 - (-2.5) = 20$

Ex 66: The following data shows the speeds (in km/h) recorded by a radar for 11 cars:

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

Find the **interquartile range** of the speeds.

$$\boxed{9}$$

Answer:

- Order the data:

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

- Median (Q_2) is the 6th value: 93

- Lower half: 87, 88, 89, 91, 92
  Q_1 is the 3rd value: 89

- Upper half: 95, 98, 100, 102, 105
  Q_3 is the 3rd value: 100

- Interquartile range: $Q_3 - Q_1 = 100 - 89 = 11$

Ex 67: The following data shows the weights (in kg) of 10 packages stored in a warehouse:

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.

$$\boxed{1.8}$$

Answer:

- Order the data:

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

- Median (Q_2) is average of 5th and 6th values: $\frac{4.8+5.0}{2} = 4.9$

- Lower half: 3.5, 3.9, 4.2, 4.4, 4.8
  Q_1 is the 3rd value: 4.2

- Upper half: 5.0, 5.2, 5.5, 6.1, 6.7
  Q_3 is the 3rd value: 5.5

- Interquartile range: $Q_3 - Q_1 = 5.5 - 4.2 = 1.3$

Ex 68: The following data shows the marks (out of 20) obtained by 9 students in a math exam:

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

Find the **interquartile range** of the marks.

$$\boxed{13}$$

Answer:

- Order the data:

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

- The median (Q_2) is the 5th value: 10

- Lower half (before the median): 1, 2, 5, 10
  $Q_1 = \frac{2+5}{2} = 3.5$

- Upper half (after the median): 11, 15, 18, 19
  $Q_3 = \frac{15+18}{2} = 16.5$

- Interquartile range: $Q_3 - Q_1 = 16.5 - 3.5 = 13$

D.4.3 CALCULATING A STANDARD DEVIATION

Ex 69: 🖩 Over my last 5 basketball games, I scored these points:

$$15, 20, 10, 2, 5$$

Find the standard deviation, rounded to 1 decimal places.

$$\sigma \approx \boxed{6.5} \text{ points}$$

Answer: First, find the mean (average):

$$\bar{x} = \frac{15 + 20 + 10 + 2 + 5}{5} = 10.4 \text{ points}$$

Then, use the standard deviation formula:

$$\sigma = \sqrt{\frac{(15-10.4)^2 + (20-10.4)^2 + (10-10.4)^2 + (2-10.4)^2 + (5-10.4)^2}{5}}$$

$$\sigma \approx 6.5 \text{ points}$$

This shows how much my scores typically vary from the average.

Ex 70: 🖩 A student earned these marks on their last 5 exams:

$$78, 85, 62, 90, 75$$

Find the standard deviation, rounded to 2 decimal places.

$$\sigma \approx \boxed{9.57} \text{ marks}$$

Answer: Start with the mean:

$$\bar{x} = \frac{78 + 85 + 62 + 90 + 75}{5} = 78 \text{ marks}$$

Next, calculate the standard deviation:

$$\sigma = \sqrt{\frac{(78-78)^2 + (85-78)^2 + (62-78)^2 + (90-78)^2 + (75-78)^2}{5}}$$

$$\sigma \approx 9.57 \text{ marks}$$

This tells us how spread out the marks are from the average.

Ex 71: 🖩 The daily temperatures (in °C) in a city over the last 5 days were:

$$22, 25, 19, 30, 24$$

Find the standard deviation, rounded to 2 decimal places.

$$\sigma \approx \boxed{3.63} \text{ °C}$$

Answer: Find the mean first:

$$\bar{x} = \frac{22 + 25 + 19 + 30 + 24}{5} = 24 \text{ °C}$$

Then, compute the standard deviation:

$$\sigma = \sqrt{\frac{(22-24)^2 + (25-24)^2 + (19-24)^2 + (30-24)^2 + (24-24)^2}{5}}$$

$$\sigma \approx 3.63 \text{ °C}$$

This shows the typical variation in daily temperatures.

Ex 72: 🖩 A small business recorded these weekly sales (in dollars) over the last 5 weeks:

$$1500, 2000, 1800, 2200, 1700$$

Find the standard deviation, rounded to the nearest integer.

$$\sigma \approx \boxed{242} \text{ dollars}$$

Answer: Calculate the mean:

$$\bar{x} = \frac{1500 + 2000 + 1800 + 2200 + 1700}{5} = 1840 \text{ dollars}$$

Then, find the standard deviation:

$$\sigma = \sqrt{\frac{(1500-1840)^2 + (2000-1840)^2 + (1800-1840)^2 + (2200-1840)^2 + (1700-1840)^2}{5}}$$

$$\sigma \approx 242 \text{ dollars}$$

This measures how much the sales fluctuate from the average.

E ORGANIZING AND DISPLAYING DATA

E.1 VISUALIZING FREQUENCIES

E.1.1 UNDERSTANDING PIE CHARTS AND BAR CHARTS

Ex 73: 30 randomly selected students were asked to name their favorite subject at school. The results of the survey are displayed in the graph.
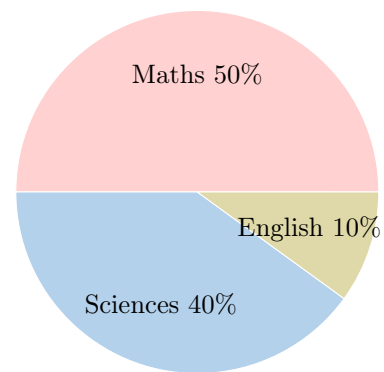
1. What sort of graph is being used?

$$\boxed{\textbf{Pie chart}}$$

2. Which was the most favoured subject?

$$\boxed{\textbf{Maths}}$$

3. What percentage of the students named Sciences as their favorite subject?

$$\boxed{40} \%$$

4. What percentage of the students chose either Maths or Sciences as their favorite subject?

$$\boxed{90} \%$$

Answer:

1. The type of graph being used is a pie chart.

2. The most favoured subject is Maths.

3. The percentage of students who named Sciences as their favorite subject is 40%.

4. The percentage of students who chose either Maths or Sciences as their favorite subject is $50\% + 40\% = 90\%$.

Ex 74: 200 randomly selected students were asked how they travel to school. The results of the survey are displayed in the graph.

Frequency
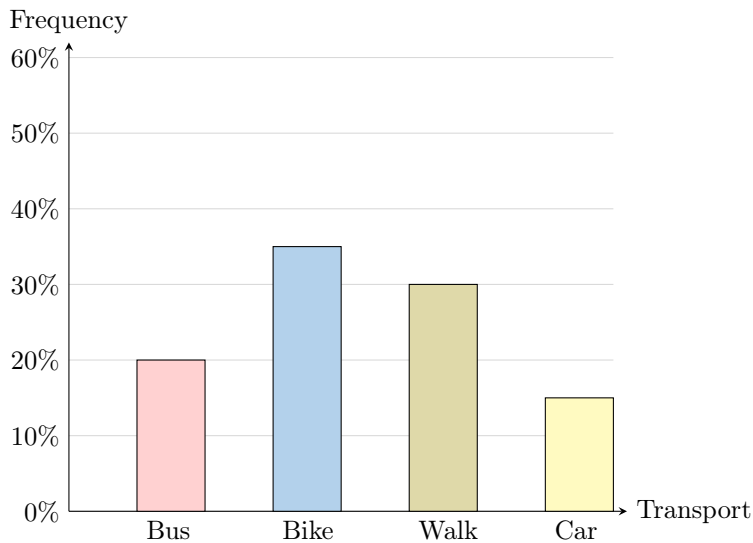
1. What sort of graph is being used?

$$\boxed{\textbf{Bar chart}}$$

2. Which was the most common mode of transportation?

$$\boxed{\textbf{Bike}}$$

3. What percentage of the students travel to school by bike?

$$\boxed{35}\ \%$$

4. What percentage of the students travel to school either by bus or bike?

$$\boxed{55}\ \%$$

Answer:

1. The type of graph being used is a bar chart.

2. The most common mode of transportation is Bike.

3. The percentage of students who travel to school by bike is 35%.

4. The percentage of students who travel to school either by bus or bike is $20\% + 35\% = 55\%$.

Ex 75: 30 randomly selected students were asked to state the number of siblings they have. The results of the survey are displayed in the graph.

1. What sort of graph is being used?

$$\boxed{\textbf{Pie chart}}$$

2. Which number of siblings is the most common?

$$\boxed{\textbf{1 Sibling}}$$

3. What percentage of the students have 2 siblings?

$$\boxed{20}\ \%$$

4. What percentage of the students have at least 1 sibling?

$$\boxed{90}\ \%$$

Answer:

1. The type of graph being used is a pie chart.

2. The most common number of siblings is 1.

3. The percentage of students who have 2 siblings is 20%.

4. The percentage of students who have at least 1 sibling is $55\% + 20\% + 10\% + 5\% = 90\%$.

Ex 76: 30 randomly selected students were asked to name their favorite sport. The results of the survey are displayed in the graph.

Frequency

1. What sort of graph is being used?

2. Which was the most favoured sport?

Soccer

3. What percentage of the students named Basketball as their favorite sport?

$\boxed{30}$ %

4. What percentage of the students chose either Soccer or Basketball as their favorite sport?

$\boxed{85}$ %

Answer:

1. The type of graph being used is a bar chart.

2. The most favoured sport is Soccer.

3. The percentage of students who named Basketball as their favorite sport is 30%.

4. The percentage of students who chose either Soccer or Basketball as their favorite sport is $55\% + 30\% = 85\%$.

E.2 VISUALIZING CENTRAL TENDENCY AND DISPERSION

E.2.1 IDENTIFYING BOX PLOTS

MCQ 77: The five-number summary (minimum, Q_1, median, Q_3, maximum) for a basketball player's scores is:
Minimum $= 1$, $Q_1 = 3.5$, Median $= 10$, $Q_3 = 16.5$, Maximum $= 19$
Select the correct box plot based on this summary.
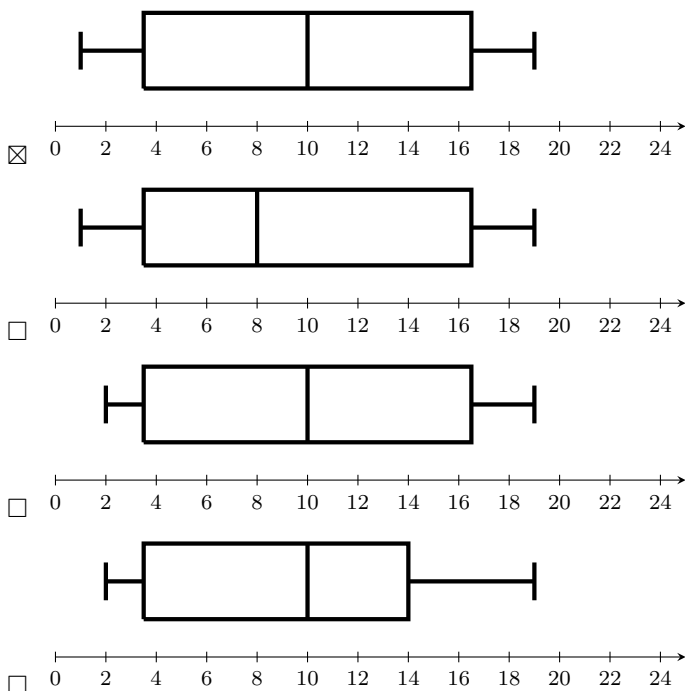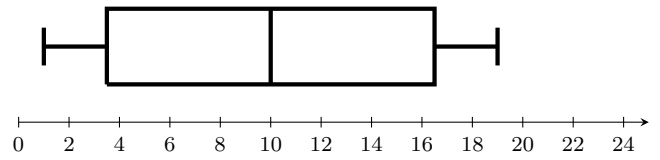
Answer:

MCQ 78: The five-number summary for minutes spent on various activities in a day is:
Minimum $= 0$, $Q_1 = 28.5$, Median $= 40$, $Q_3 = 58.5$, Maximum $= 100$
Select the correct box plot based on this summary.
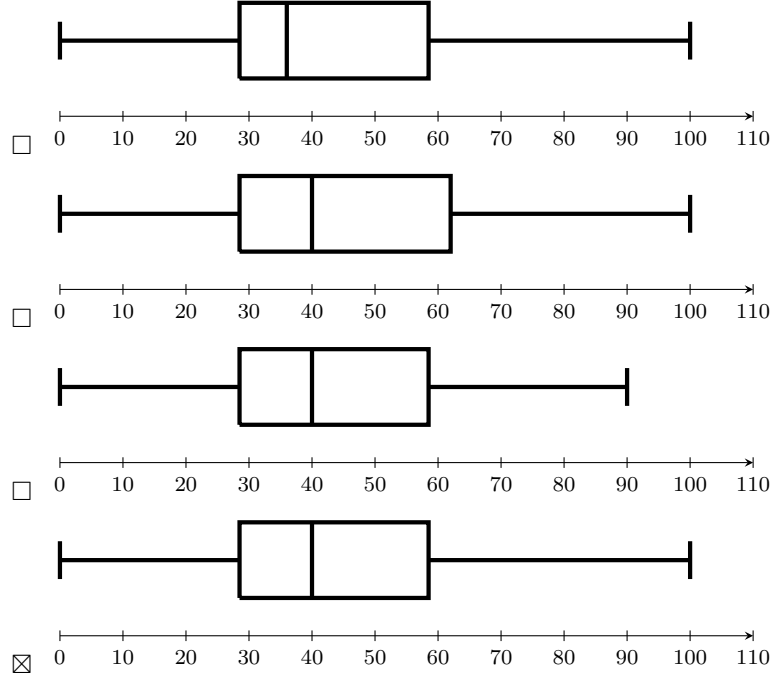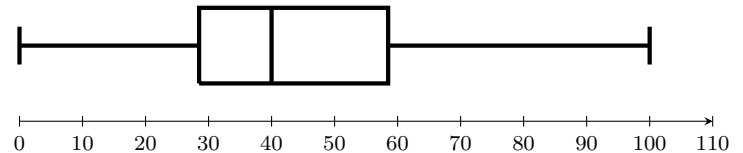
Answer:

MCQ 79: The five-number summary for the average monthly temperatures (in °C) is:
Minimum $= -5$, $Q_1 = 2$, Median $= 12.5$, $Q_3 = 20$, Maximum $= 30$
Select the correct box plot based on this summary.

□
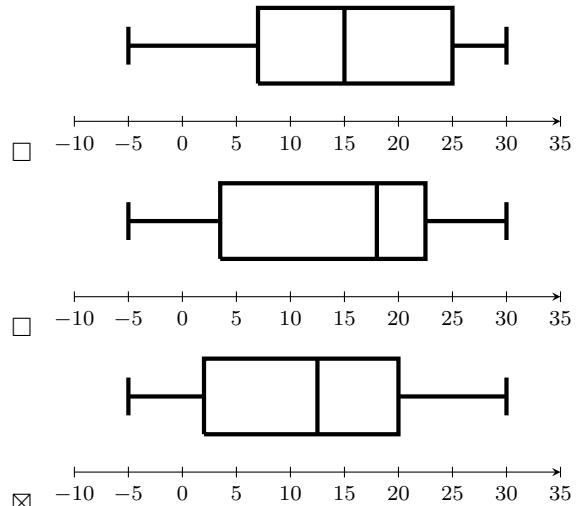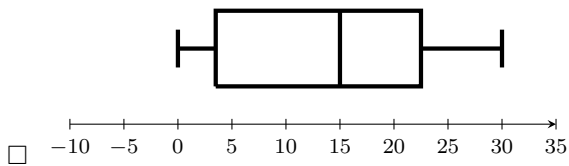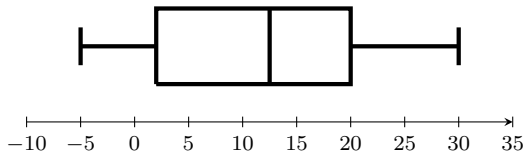
Answer:

MCQ 80: The five-number summary for the average monthly air quality index (AQI) is:
Minimum $= 35$, $Q_1 = 50$, Median $= 60$, $Q_3 = 65$, Maximum $= 75$
Select the correct box plot based on this summary.

⊠

□

□

□
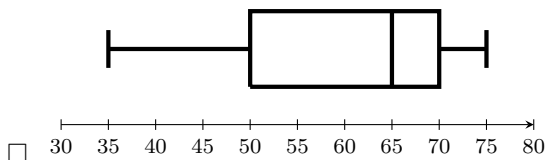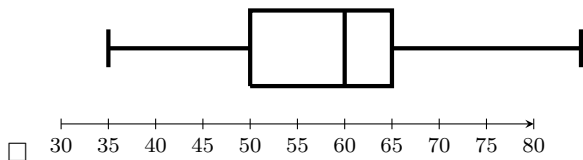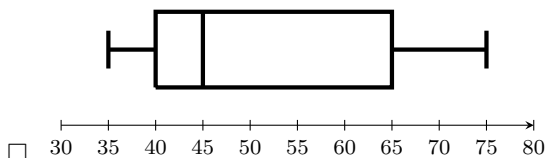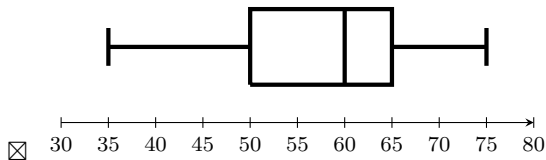
Answer:
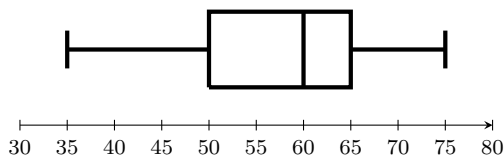
E.2.2 PLOTTING BOX PLOTS

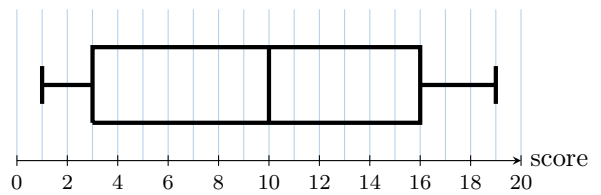**Ex 81:** We record the score of a basketball player during a season.
The five-number summary for the player's scores is:

Minimum $= 1$, $Q_1 = 3$, Median $= 10$, $Q_3 = 16$, Maximum $= 19$

Plot the corresponding box plot based on this summary on the grid below.
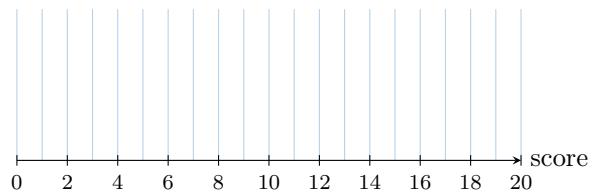
Answer: Here is the completed box plot:

Ex 82: We record the temperature (in °C) in Dubai throughout the year.
The five-number summary for the temperatures is:

Minimum $= 14$, $Q_1 = 20$, Median $= 29$, $Q_3 = 36$, Maximum $= 43$

Plot the corresponding box plot based on this summary on the grid below.
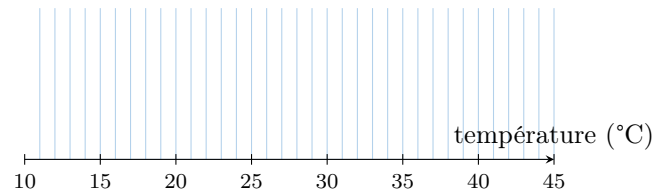
Answer: Here is the completed box plot:
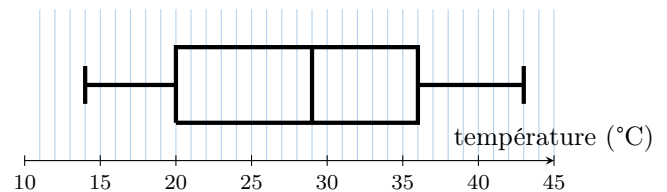
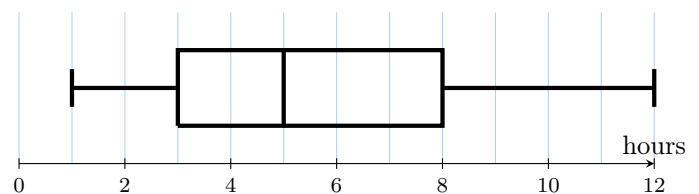**Ex 83:** We record the number of hours spent reading each week by students in a class.
The five-number summary for these reading hours is:

Minimum $= 1$, $Q_1 = 3$, Median $= 5$, $Q_3 = 8$, Maximum $= 12$

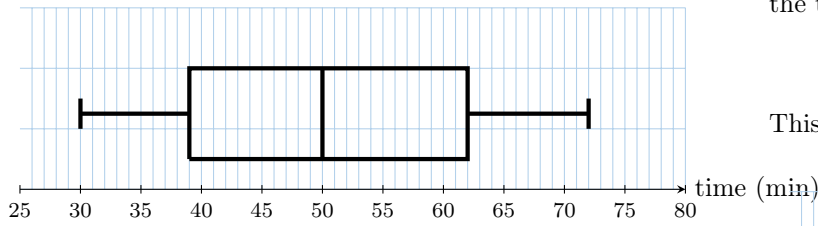Plot the corresponding box plot based on this summary on the grid below.
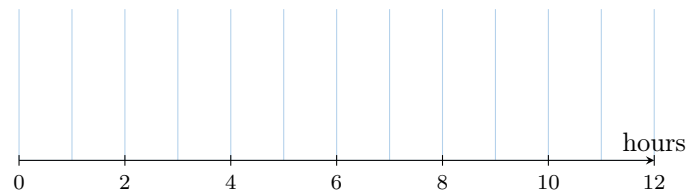
Answer: Here is the completed box plot:

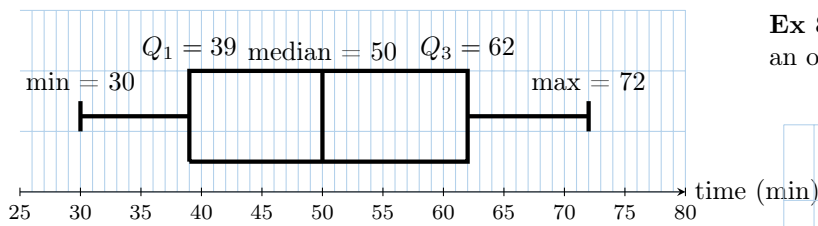## E.2.3 UNDERSTANDING BOX PLOTS

**Ex 84:** Here's a box plot showing how many minutes passengers spent waiting in an airport departure lounge.

What's the shortest time a passenger spent waiting in the lounge?

$\boxed{30}$ minutes

*Answer:* The shortest time is shown by the minimum value on the box plot, which is 30 minutes.

Ex 85: This box plot shows the waiting times (in minutes) for passengers in an airport departure lounge.
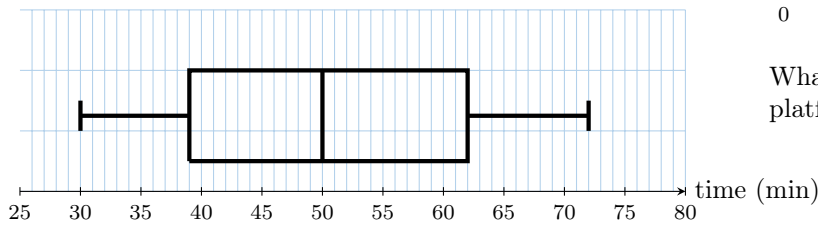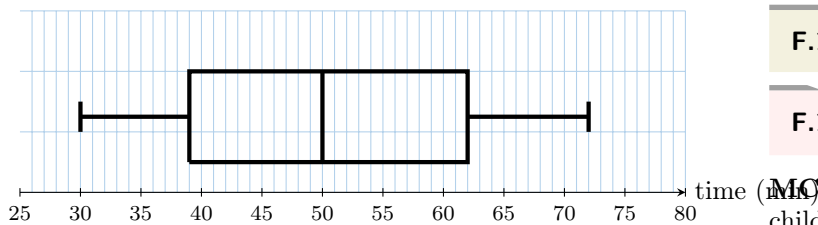

If 75% of passengers waited longer than a certain amount of time, what was that time?

$\boxed{39}$ minutes

Answer: If 75% of passengers waited longer than a certain amount of time, that time is the first quartile (Q_1), which is 39 minutes.
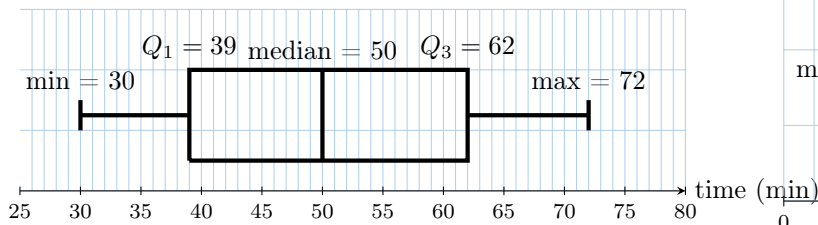
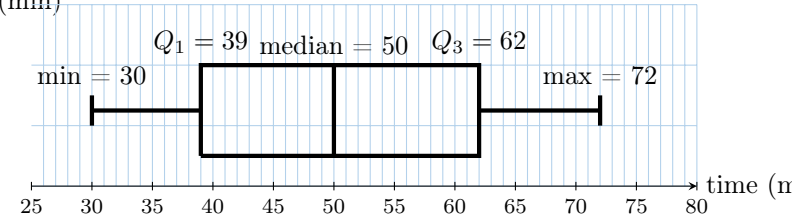**Ex 86:** Here's a box plot of the waiting times (in minutes) for passengers in an airport departure lounge.

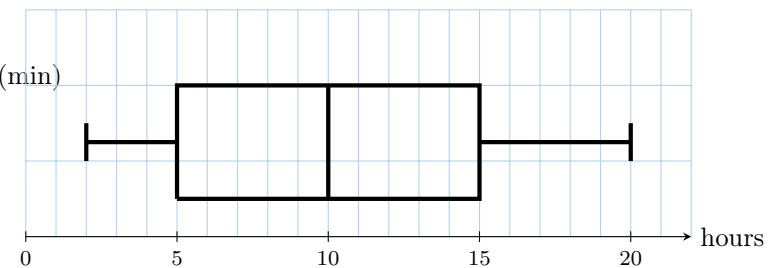What's the interquartile range (IQR) of these waiting times?

$\boxed{23}$ minutes

Answer: The interquartile range (IQR) is the difference between the third quartile (Q_3) and the first quartile (Q_1):

$$\text{IQR} = Q_3 - Q_1 = 62 - 39 = 23 \text{ minutes.}$$

This is the range where the middle 50% of the data are found.

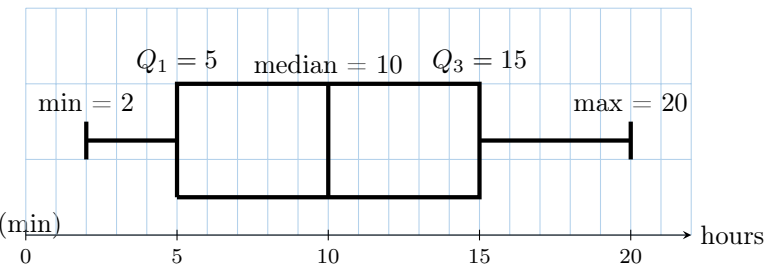**Ex 87:** This box plot shows how many hours students spent on an online learning platform in one week.

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

$\boxed{10}$ hours

Answer: The interquartile range (IQR) is the difference between the third quartile (Q_3) and the first quartile (Q_1):

$$\text{IQR} = Q_3 - Q_1 = 15 - 5 = 10 \text{ hours.}$$

This covers the middle 50% of the data.

F INTERPRETING THE STATISTICS

F.1 READING AND COMPARING DATA

F.1.1 INTERPRETING RELATIVE FREQUENCY

MCQ 88: This table shows the relative frequency of beverage children drink:

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

Check the statements that are true:

☒ Water is the most popular beverage among children.

☒ Milk is the least popular beverage among children.

☐ Soda is more popular than Juice.

☐ Milk is the most popular beverage.

☒ Water makes up more than half of all drinks.

☒ Juice and Soda together are less popular than Water alone.

Answer:

- Water is the most popular beverage among children. **True** – Water has the highest percentage at 55%.

- Milk is the least popular beverage among children. **True** – Milk is the lowest at 5%.

- Soda is more popular than Juice. **False** – Juice (30%) beats Soda (10%).

- Milk is the most popular beverage. **False** – Milk is the least popular at 5%.

- Water makes up more than half of all drinks. **True** – 55% is over half.

- Juice and Soda together are less popular than Water alone. **True** – Juice (30%) + Soda (10%) = 40%, less than Water's 55%.

MCQ 89: This table shows how students get to school, based on relative frequency:

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

Check the statements that are true:

☒ 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 together make up more than half.

☒ Bus is the least popular way to get to school.

Answer:

- Walking is the most popular way to get to school. **True**

- Car and Bus are equally popular. **True** (15% each)

- Bicycle is more popular than Bus. **True** (30% vs 15%)

- More students take the Bus than walk. **False**

- Bicycle and Walking together make up more than half. **True** (40+30=70%)

- Bus is the least popular way to get to school. **True** (tied with Car)

MCQ 90: Here's a table showing the relative frequency of students' favorite pet:

Pet Type	Relative Frequency
Dogs	27%
Cats	43%
Fish	20%
Birds	10%

Check the statements that are true:

☒ Cats are the most popular pets among students.

☒ Birds are the least popular pets among students.

☐ More students own Fish than Dogs.

☒ Cats and Fish together make up more than half of all pets.

☐ Dogs are more popular than Cats.

☒ Birds and Dogs together make up more than Fish.

Answer:

- Cats are the most popular pets among students. **True**

- Birds are the least popular pets among students. **True**

- More students own Fish than Dogs. **False**

- Cats and Fish together make up more than half of all pets. **True** (43+20=63%)

- Dogs are more popular than Cats. **False**

- Birds and Dogs together make up more than Fish. **True** (10+27=37% > 20%)

MCQ 91: Here's a table showing the relative frequency of students' favorite subject:

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

Check the statements that are true:

☒ Maths is the most popular subject among students.

☒ English is the least popular subject among students.

☒ Maths and Science are almost equally popular among students.

☐ Students get good grades in Maths.

☐ English is the most popular subject among students.

Answer:

- Maths is the most popular subject among students. **True** – At 46%, Maths has the highest percentage.

- English is the least popular subject among students. **True** – English has the lowest percentage at 10%.

- Maths and Science are almost equally popular among students. **True** – Maths (46%) and Science (44%) are very close.

- Students get good grades in Maths. **False** – This table is about favorites, not grades.

- English is the most popular subject among students. **False** – English is the least popular, not the most.

F.1.2 INTERPRETING RELATIVE FREQUENCY

Ex 92: Here's a pie chart showing what kids drink most often:
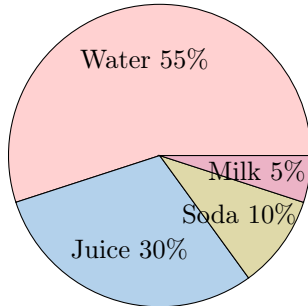
Answer these questions based on the pie chart:

1. Which drink do kids choose the most?

$$\boxed{\textbf{Water}}$$

2. Which drink do kids choose the least?

$$\boxed{\textbf{Milk}}$$

3. Do more kids drink soda than juice?

$$\boxed{\textbf{No}}$$

Answer:

1. Water – It's the biggest slice at 55%.

2. Milk – It's the smallest slice at 5%.

3. No – Juice (30%) is more than Soda (10%).

Ex 93: This bar graph shows how students spend their free time:
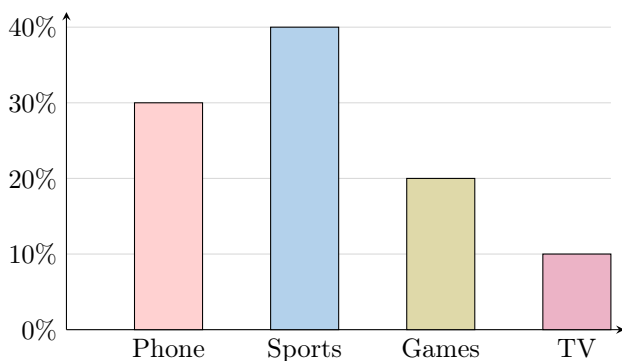
Answer these questions based on the bar graph:

1. What's the most popular activity?

$$\boxed{\textbf{Sports}}$$

2. What's the least popular activity?

$$\boxed{\textbf{TV}}$$

3. Do more students play games than use their phones?

$$\boxed{\textbf{No}}$$

Answer:

1. Sports – It's the tallest bar at 40%.

2. TV – It's the shortest bar at 10%.

3. No – Phones (30%) are more popular than Games (20%).

Ex 94: This pie chart shows how much time students spend studying different subjects:
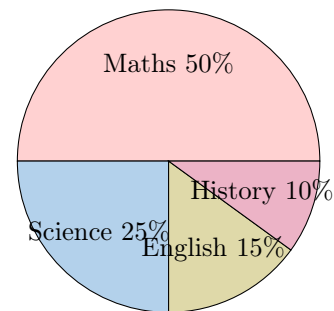
Answer these questions based on the pie chart:

1. Which subject gets the most study time?

$$\boxed{\textbf{Maths}}$$

2. Which subject gets the least study time?

$$\boxed{\textbf{History}}$$

3. Do students spend more time on English than Science?

$$\boxed{\textbf{No}}$$

Answer:

1. Maths – It's the biggest slice at 50%.

2. History – It's the smallest slice at 10%.

3. No – Science (25%) is more than English (15%).

Ex 95: This bar graph shows how many siblings students have:

1. What's the most common number of siblings?

$$\boxed{\mathbf{0}}$$

2. What's the least common number of siblings?

$$\boxed{\mathbf{3+}}$$

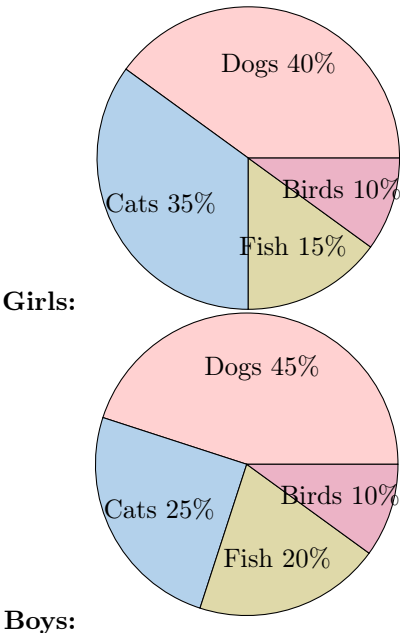3. Do more students have 1 sibling than none?

$$\boxed{\mathbf{No}}$$

Answer:

1. 0 – It's the tallest bar at 40%.

2. 3+ – It's the shortest bar at 10%.

3. No – 0 siblings (40%) is more than 1 sibling (30%).

F.1.3 COMPARING USING PIE CHARTS

MCQ 96: Here are pie charts showing the favorite pets for girls and boys:

Girls:

Boys:
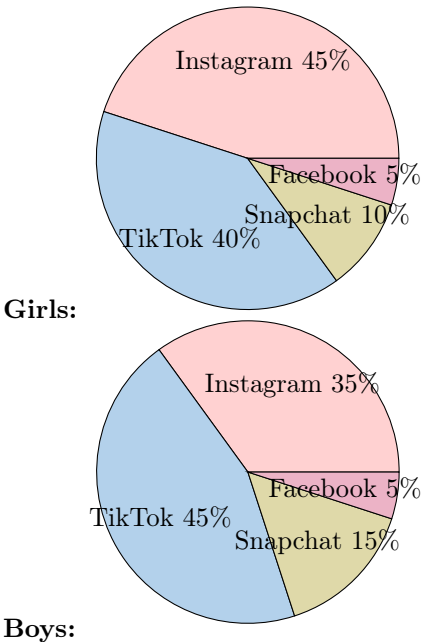
Check the true statements about these favorite pets:

- ☒ "Dogs are the favorite pet for both girls and boys."
- ☒ "Girls like cats more than boys do."
- ☐ "Boys like fish less than girls do."
- ☒ "Birds are equally popular with girls and boys."

Answer:

- "Dogs are the favorite pet for both girls and boys." **True** – Dogs have the biggest slice for girls (40%) and boys (45%).

- "Girls like cats more than boys do." **True** – Girls have 35% for cats, while boys have 25%.

- "Boys like fish less than girls do." **False** – Boys have 20% for fish, while girls have 15%.

- "Birds are equally popular with girls and boys." **True** – Both have 10% for birds.

MCQ 97: Here are pie charts showing the favorite social media apps for girls and boys:


Girls:

Boys:

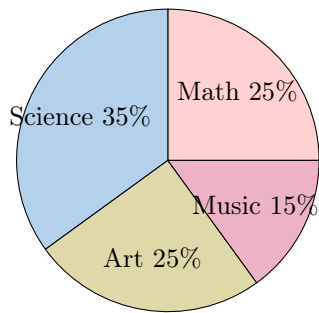**Check the true statements about these favorite apps:**

- ☐ Instagram is the favorite app for both girls and boys.
- ☒ Boys like TikTok more than girls do.
- ☐ Girls like Snapchat more than boys do.
- ☒ Facebook is the least popular app for both.

Answer:

- Instagram is the favorite app for both girls and boys. **False**

- Boys like TikTok more than girls do. **True** – Boys: 45%, Girls: 40%

- Girls like Snapchat more than boys do. **False** – Girls: 10%, Boys: 15%

- Facebook is the least popular app for both. **True** – Both: 5%

MCQ 98: Here are pie charts showing the favorite school subjects in Country A and Country B:
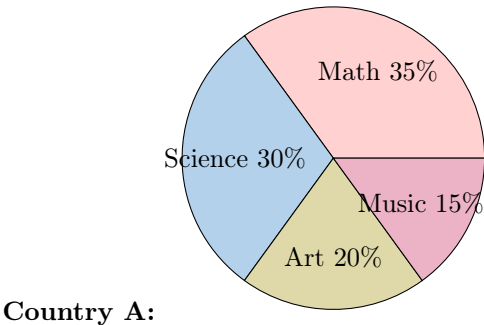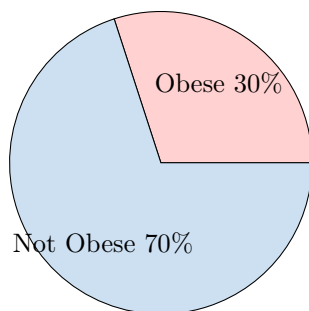

Country A:

Country B:

Check the true statements about these favorite subjects:

☒ "Country A loves math more than Country B does."

☐ "Science is the least favorite subject in Country B."

☒ "Art is more popular in Country B than in Country A."

☒ "Music has the same fans in both countries."

Answer:

- "Country A loves math more than Country B does." **True** – Country A has 35% for math, while Country B has 25%.

- "Science is the least favorite subject in Country B." **False** – Science is 35% in Country B, the highest, not the lowest (Music is 15%).

- "Art is more popular in Country B than in Country A." **True** – Country B has 25% for art, while Country A has 20%.

- "Music has the same fans in both countries." **True** – Both have 15% for music.

MCQ 99: Here are pie charts showing the percentage of adults who are obese in Country A and Country B:
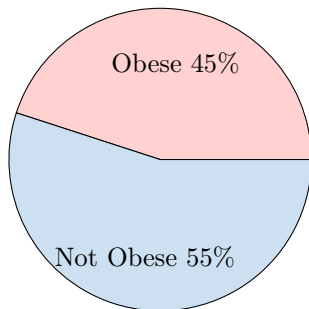
Country A:

Country B:

Check the true statements about obesity in these countries:

☒ "Country B has a bigger obesity problem than Country A."

☐ "More than half of adults in Country A are obese."

☒ "Country A has more non-obese adults than Country B."

☒ "The obesity rate in Country B is higher than 40%."

Answer:

- "Country B has a bigger obesity problem than Country A." **True** – Country B has 45% obese, while Country A has 30%.

- "More than half of adults in Country A are obese." **False** – Country A has 30% obese, which is less than 50%.

- "Country A has more non-obese adults than Country B." **True** – Country A has 70% non-obese, while Country B has 55%.

- "The obesity rate in Country B is higher than 40%." **True** – Country B's obesity rate is 45%, which is above 40%.

F.1.4 COMPARING USING CENTRAL TENDENCIES

Ex 100: The girls' average score in math is 87 (B+), while the boys' average is 75 (C). Are girls better at math?

Answer: Yes, since 87 > 75, on average, girls perform better than boys in math.

Ex 101: The average salary of employees in Company A is $65,000, while in Company B, it is $58,000. Does Company A pay higher salaries on average?

Answer: Yes, since $65,000 > $58,000, employees at Company A earn more on average.

Ex 102: The mean summer temperature in City P is 26°C, while in City Q, it is 29°C. Which city is hotter on average?

Answer: City Q, since 29°C > 26°C, making it the hotter city on average.

Ex 103: 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 in income?

Answer: Neighborhood A, since $82,000 > $68,500, indicating higher typical household income.

F.1.5 COMPARING CENTRAL TENDENCY AND DISPERSION

MCQ 104: Company A reports an average salary of $50,000, while Company B reports an average salary of $55,000. Can we say that the average salary is higher in Company A?

☐ Yes

☒ No

☐ The data are insufficient to answer

Answer:

- The question is whether the average salary is higher in Company A.

- The data show an average of $50,000 for Company A and $55,000 for Company B.

- So, the average salary is **not** higher in Company A. It is higher in Company B.

MCQ 105: In 2023, the average temperature was 22° C. In 2024, it was 24° C. Can we conclude that temperatures were more variable in 2024?

☐ Yes

☐ No

☒ The data are insufficient to answer

Answer:

- The question asks about temperature variability.

- We are only given average values for each year, not any measure of dispersion.

- To compare variability, we need data such as the range, standard deviation, or interquartile range.

- So we **cannot determine** if temperatures were more variable in 2024.

MCQ 106: Store A and Store B both have an average daily sale of $1,500. However, Store A's daily sales ranges from $1,000 to $2,000, while Store B's ranges from $1,400 to $1,600. Does this mean that the sales were more variable in Store A than in Store B?

☒ Yes

☐ No

☐ The data are insufficient to answer

Answer:

- The question is about sales variability.

- The range of Store A's sales is $1,000 ($2,000 - 1,000$), while Store B's is $200 ($1,600 - 1,400$).

- A larger range suggests more variability.

- So, **sales are more variable in Store A**.

MCQ 107: In a study, the average height of girls was 160 cm, and the average height of boys was 162 cm. Are girls taller than boys on average?

☐ Yes

☒ No

☐ The data are insufficient to answer

Answer:

- The question asks whether girls are taller than boys on average.

- The data show that girls average 160 cm, while boys average 162 cm.

- So, **on average, girls are not taller than boys**.

MCQ 108: 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?

☐ Yes

☐ No

☒ The data are insufficient to answer

Answer:

- The question concerns salary inequality based on the IQR.

- A higher IQR means greater spread of salaries.

- Since the IQR increased from $20,000 to $25,000, this suggests **more salary inequality in 2023**.

F.1.6 COMPARING CENTRAL TENDENCY AND DISPERSION

Ex 109: 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?

Answer:

- The question concerns salary inequality based on the IQR.

- A higher IQR means greater spread of salaries.

- Since the IQR increased from $20,000 to $25,000, this suggests **more salary inequality in 2023**.

Ex 110: In two schools, the average grade on the national math exam was 14 out of 20. However, in School A, the interquartile range (IQR) was 4, while in School B, it was 7. Which school had more variability in students' results?

Answer:

- Both schools have the same average (14/20), but the IQR differs.

- A higher IQR indicates more dispersion among students' grades.

- Since the IQR is greater in School B, student results are more variable there.

Ex 111: In City X, the average income in 2023 was $40,000 with an interquartile range (IQR) of $10,000. In City Y, the average income was $45,000, but the IQR was $18,000. Which city shows more income disparity?

Answer:

- City Y has a larger IQR.

- A larger IQR means that income values are more spread out around the median.

- So, there is more income disparity in City Y.

Ex 112: Investment A had an average return of $5,000 per year, with an interquartile range (IQR) of $2,000. Investment B had an average return of $6,000 per year, with an IQR of $4,000. If we only care about average return, which investment is more attractive?

Answer:

- The question focuses only on the average return.

- Investment A has an average return of \$5,000, and B has \$6,000.

- Therefore, Investment B is more attractive based on average return alone.

Ex 113: Investment A had an average return of \$5,000 per year, with an interquartile range (IQR) of \$2,000. Investment B had an average return of \$6,000 per year, with an IQR of \$4,000. If we prefer a safer investment with more predictable returns, which one should we choose?

Answer:

- The question focuses on choosing the safer investment, not necessarily the most profitable.

- A smaller IQR means more stable and predictable returns.

- Investment A has a lower IQR (\$2,000), so it is the safer choice.

F.1.7 INTERPRETING BOX PLOT

**MCQ 114:** This box plot shows how many minutes passengers waited in an airport lounge:
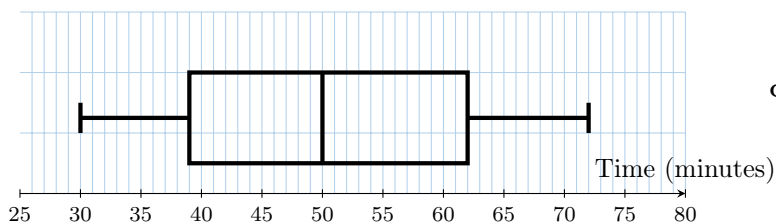
Time (minutes)

Check the true statements airport staff might say about the wait times:

☒ "Half the passengers wait more than 50 minutes, so we need more seats and fun things to do."

☒ "Since 25% wait over 62 minutes, we should speed up security and check-in."

☐ "The shortest wait time was 72 minutes."

Answer:

- **True** – "Half the passengers wait more than 50 minutes, so we need more seats and fun things to do." (The median is 50, so half waited more.)

- **True** – "Since 25% wait over 62 minutes, we should speed up security and check-in." (The third quartile Q3 is 62, so 25% waited more.)

- **False** – "The shortest wait time was 72 minutes." (72 is the longest wait; the shortest was 30 minutes.)

MCQ 115: This box plot shows how many hours per week students in a music school spent practicing their instrument:
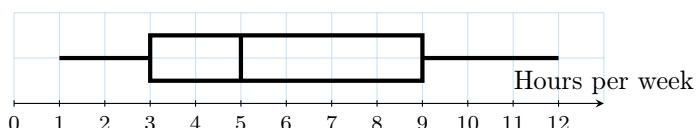

Hours per week

Check the true statements the school director might say about practice times:

☒ "The middle 50% of students practice between 3 and 9 hours per week."

☐ "Every student practices at least 3 hours per week."

☒ "At least 75% of students practice less than 9 hours per week."

Answer:

- **True** – "The middle 50% of students practice between 3 and 9 hours per week." (This is the box: from Q1 to Q3.)

- **False** – "Every student practices at least 3 hours per week." (Minimum is 1, so some practice less than 3.)

- **True** – "At least 75% of students practice less than 9 hours per week." (Q3 = 9, so 75

MCQ 116: This box plot shows students' scores on a reading test (out of 100):
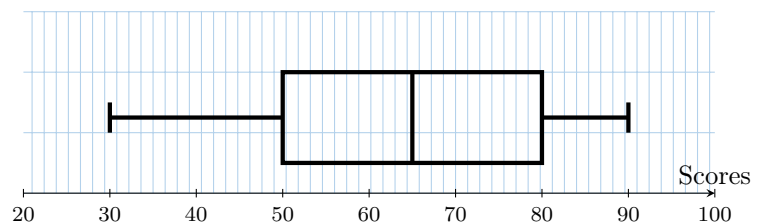
Scores

**Check the true statements test organizers might say about the scores:**

☒ "Half the students scored over 65, so lots of them did well on reading."

☒ "Since 25% scored below 50, some students might need extra reading help."

☐ "The lowest score was 90."

Answer:

- **True** – "Half the students scored over 65, so lots of them did well on reading." (The median is 65, so half scored above this value.)

- **True** – "Since 25% scored below 50, some students might need extra reading help." (Q1 is 50, so 25% scored below this.)

- **False** – "The lowest score was 90." (90 is the highest score, not the lowest, which is 30.)

F.1.8 COMPARING BOX PLOTS

**MCQ 117:** These box plots show the daily temperatures (in °C) in City A and City B over a year:
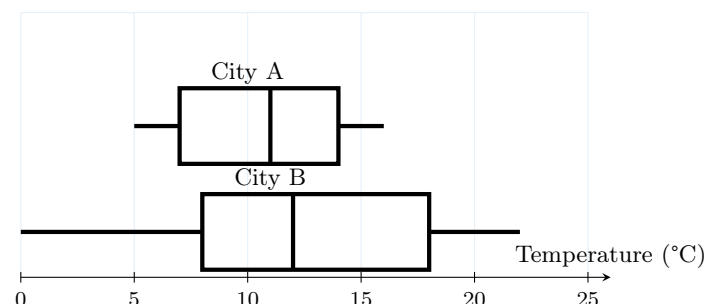
Imagine you're a weather expert. Check the true statements about these cities:

☒ "City B's temperatures vary over a wider range than City A's."

☐ "City A's coldest days are colder than any in City B."

Answer:

- **True** – "City B's temperatures vary over a wider range than City A's." (City B: 0°C to 22°C, range = 22°C; City A: 5°C to 16°C, range = 11°C.)

- **False** – "City A's coldest days are colder than any in City B." (City A's minimum is 5°C, but City B's is 0°C, so City B gets colder.)

MCQ 118: These box plots show the yearly salaries (in thousands of dollars) in State A and State B:
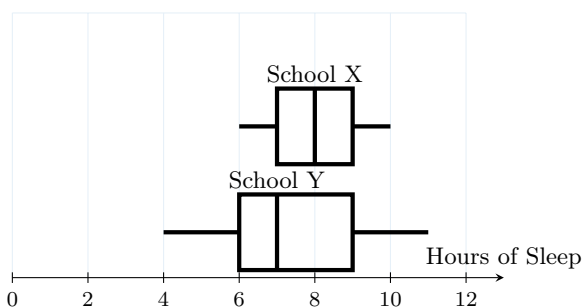

State A
State B
Salary (thousands of $)
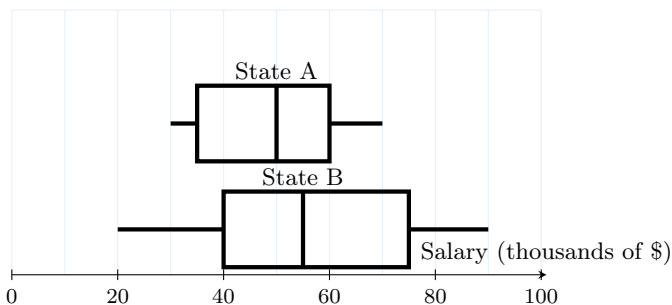
Check the true statements about these states:

☐ "Salaries in State A cover a wider range than in State B."

☒ "The middle salary in State B is higher than in State A."

☒ "State B has a bigger mix of high and low salaries than State A."

Answer:

- **False** – "Salaries in State A cover a wider range than in State B." (State A: $30k–$70k, range = $40k; State B: $20k–$90k, range = $70k. State B covers a wider range.)

- **True** – "The middle salary in State B is higher than in State A." (Median for State B is $55k, for State A it's $50k.)

- **True** – "State B has a bigger mix of high and low salaries than State A." (State B's minimum is lower and its maximum is higher than State A's.)

MCQ 119: These box plots show the hours of sleep per night for teens in School X and School Y over a month:

School X
School Y
Hours of Sleep

Imagine you're a sleep scientist. Check the true statements about these teens:

☒ "Teens in School X have more regular sleep hours than those in School Y."

☒ "School X teens usually sleep more than the sleepiest teens in School Y."

Answer:

- **True** – "Teens in School X have more regular sleep hours than those in School Y." (School X's range is 4 hours, School Y's is 7 hours: more consistency for X.)

- **True** – "School X teens usually sleep more than the sleepiest teens in School Y." (School X's minimum is 6 hours, higher than School Y's minimum of 4 hours.)

F.2 BE CRITICAL: STATISTICAL ERROR AND TENDENCY

F.2.1 ASSERTING A TENDENCY OR AN ABSOLUTE STATEMENT

Ex 120: A school newspaper reports: "The average score in science is higher for Class 1 than for Class 2. So, every student in Class 1 is better at science than every student in Class 2."
Do you agree with this statement? Explain your answer.

Answer: No, I do not agree. A higher average only means that, overall, students in Class 1 tend to score better, but there may be students in Class 2 who have higher scores than some in Class 1. The average only describes the group as a whole, not every individual. There can be overlap between the groups.

Ex 121: A sports magazine reports: "The slowest runner in Team A finished the race faster than the fastest runner in Team B. So, every runner in Team A is faster than every runner in Team B."
Do you agree with this statement? Explain your answer.

Answer: Yes, I agree. If the slowest runner in Team A finished faster than the fastest runner in Team B, then every runner in Team A was faster than every runner in Team B. There is no overlap in their race times.

Ex 122: A music blog reports: "The average score in the piano competition was higher for participants from School X than from School Y. So, every pianist from School X played better than every pianist from School Y."
Do you agree with this statement? Explain your answer.

Answer: No, I do not agree. A higher average only means that, overall, School X participants performed better, but some pianists from School Y could have higher scores than some from School X. The average does not guarantee everyone in School X did better than everyone in School Y.

Ex 123: A website about basketball writes: "The tallest player on Team Red is shorter than the shortest player on Team Blue. So, every player on Team Blue is taller than every player on Team Red."
Do you agree with this statement? Explain your answer.

Answer: Yes, I agree. If the tallest player on Team Red is shorter than the shortest player on Team Blue, then every player on Team Blue is taller than every player on Team Red. There is no overlap.