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Assignment 1

NEU_COE_INFO6105_Fall2024

Instructions:

To answer non-programming questions, please type or handwrite your final answers clearly in the boxes. Show all work - credit will only be given for numerical solutions that appear with explanation in the space above the boxes.

[Total 60 pts = 6 + 21 + 9 + 21 pts + 3 Extra Credit pts]

Grading Rubric

Each question is worth 3 points and will be graded as follows:

3 points: Correct answer with work shown

2 points: Incorrect answer but attempt shows some understanding (work shown)

1 point: Incorrect answer but an attempt was made (work shown), or correct answer without explanation (work not shown)

0 points: Left blank or made little to no effort/work not shown

Review of Arithmetic and Algebra Needed for this course

1. **Finding the change in quantity [6 pts]:** In New York City, the average speed of taxis was 8.2 miles per hour in 2015 and 6.9 miles per hour in 2016 (Source: Fix NYC Advisory Panel Report). Is the change in average speed positive or negative? Find the change in the average speed in percentage with two decimals.

Answer: (1) Positive or Negative

The change in average speed is negative as there was a decrease in average speed from 2015 to 2016.

$$\begin{aligned} 2015 \text{ avg. speed} &= 8.2 \text{ miles/hr} \\ 2016 \text{ avg speed} &= 6.9 \text{ miles/hr} \\ \therefore \text{Change} &= 6.9 - 8.2 = \underline{-1.3 \text{ miles/hr}} \end{aligned}$$

(2) Change in Percentage

$$\begin{aligned} \text{Original value} &= 8.2 \text{ miles/hr} \\ \text{Change in value} &= -1.3 \text{ miles/hr} \\ \text{Percentage change} &= \left(\frac{\text{Change in value}}{\text{Original value}} \right) \times 100 \\ \text{Percentage change} &= \frac{-1.3}{8.2} \times 100 = -15.8536\% \\ \text{Rounding to 2 decimal places i.e.,} &= \underline{-15.85\%} \end{aligned}$$

2. **Interpreting ratios [21 pts]:** A total of 1824 adults were asked the following question: "Do you favor or oppose the death penalty for persons convicted of murder?" The following table compares the adults' responses with their ethnicities.

	African American	Caucasian	Other	Total
Favor	128	953	108	1189
Oppose	140	414	81	635
Total	268	1367	189	1824

Source: General Social Survey

- a. Find the number of Caucasians in the survey who oppose the death penalty.

Answer: *From the table the number of Caucasians who oppose the death penalty = 414*

- b. Find the number of African Americans in the survey who oppose the death penalty.

Answer: *From the table the number of African American who oppose the death penalty = 140*

- c. For the Caucasians in the study, find the unit ratio of the number who oppose the death penalty to the number who are in favor.

Answer:

Total number of Caucasians = 1367

Ratio of Those who favor = $953/1367$

$$= 0.6971 : 1$$

$$\approx 0.70 : 1 \text{ (Rounding to 2 decimal places)}$$

$$\frac{953}{1367} : \frac{1367}{1367}$$

Caucasians in favor

From table, Caucasian in favor = 953

Ratio of Those who oppose = $414 : 1367$

$$= 0.3029 : 1$$

$$\approx 0.30 : 1 \text{ (Rounding to 2 decimal places)}$$

$$\frac{414}{1367} : \frac{1367}{1367}$$

Caucasians against

From table, Caucasian against = 414

- d. For the African Americans in the study, find the unit ratio of the number who oppose the death penalty to the number who are in favor.

Answer:

Total number of African Americans = 268

Ratio of those in favor = $128 : 268$

$$= 0.4776 : 1$$

$\approx 0.48 : 1$ (Rounding to 2 decimal places)

$$\frac{128}{268} : \frac{268}{268}$$

African American in favor

From table, African American in favor = 128

Ratio of those who oppose = $140 : 268$

$$= 0.5224 : 1$$

$\approx 0.52 : 1$ (Rounding to 2 decimal places)

$$\frac{140}{268} : \frac{268}{268}$$

African American against

From table, African American against = 140

- e. A student says that Caucasians in the study are more likely to oppose the death penalty than African Americans in the study because more Caucasians oppose the death penalty than African Americans. What would you tell the student?

Answer:

The student's reasoning is incorrect because they are looking at the total number of people who oppose the death penalty, not the proportion within each group.

While ^{more} Caucasians oppose the death penalty in total, this doesn't mean that Caucasians are more likely to oppose it.

When you compare the proportions:

- For Caucasians, about 0.43 oppose the death penalty for every 1 in favor ($414/953 \approx 0.43:1$)
- For African American, about 1.09 oppose the death penalty for every 1 in favor ($128/140 \approx 1.09:1$)

This shows that African Americans are actually more likely to oppose the death penalty than Caucasians.

3. Using an expression to model a situation [9 pts]: The percentage of Americans who have listened to a podcast was 33% in 2015 and has increased by about 3.25 percentage points per year since then (Source: Edison Research and Triton Digital).

- a. Complete the following table to help find an expression for the percentage of Americans who have listened to a podcast at t years since 2015. Use arithmetic to help you see a pattern.

Answer: [Fill in your expressions in the BOLD boxes]

From the table we see that- for each year, we add 3.25 to the initial 33%.

∴ For t years, we add 3.25 multiplied by t to 33.

Year since 2015	Percent
0	33
1	$33 + (3.25 \times 1) = 36.25$
2	$33 + (3.25 \times 2) = 39.5$
3	$33 + (3.25 \times 3) = 42.75$
t	$33 + 3.25t$

- b. Evaluate the expression you found in Problem (a) for $t = 7$. What does your result mean in this situation?

Answer:

This result means that 7 years after 2015 (i.e., 2022) the model predicts that approximately 55.75% of Americans would have listened to podcast.

<p>Expression $\rightarrow 33 + 3.25t$</p> <p>For $t = 7 \rightarrow 33 + 3.25(7)$</p> <p style="text-align: center;">$33 + 22.75$</p> <p style="text-align: center;">$= 55.75$</p> <p style="text-align: center;"><u><u>55.75</u></u></p>	<p>Ans = <u>55.75</u></p>
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4. Ratios and scientific notation [21 pts]:

- a. For each planet in our solar system, including Earth, search on the Internet for the average distance that the planet is from the sun. Construct a table listing the planets in the first column and the distances in kilometers in the second column.

Answer: [Fill in your answers in the BOLD boxes]

Planets	distance (km)	Scientific notation	Ratio to Earth (AU)
Mercury	57,909,227	5.79×10^7	0.39
Venus	108,209,475	1.08×10^8	0.72
Earth	149,598,262	1.50×10^8	1.00
Mars	227,943,824	2.28×10^8	1.52
Jupiter	778,340,821	7.78×10^8	5.20
Saturn	1,426,666,422	1.43×10^9	9.54
Uranus	2,870,658,186	2.87×10^9	19.19
Neptune	4,498,396,441	4.50×10^9	30.07

- b. In the third column of the table you constructed in Problem (a), write the distances using scientific notation. Describe at least one benefit of using scientific notation in the box below.

Answer:

• It makes very large numbers easier to read & compare at a glance.
 • It simplifies calculations involving these large numbers, reducing the risk of errors.

- c. In the fourth column of the table you constructed in Problem (a), write the ratio of each planet's distance to the Earth's distance.

- d. The results you found in Problem (c) have units called astronomical units (AU). What does it mean for a planet's distance to be less than 1 AU? What would it mean if a planet's distance were 3 AU?

Answer:

• If planet's distance is less than 1 AU, it means the planet is closer to the sun than Earth.
 • If a planet's distance were 3 AU, it would mean the planet is 3 times farther from the sun than Earth.

- e. Which planet is closest to the sun? Which planet is farthest?

Answer:

Mercury is closest to the sun. Neptune is farthest from the sun.

- f. Describe at least one benefit of using astronomical units.

Answer:

• It simplifies comparisons between planetary distances.
 • It provides a more intuitive scale for understanding distance within our solar system.
 • It allows for easier calculations in orbital mechanics and space mission planning.

Reflective Journal [3 pts Extra Credit]

(Copy and paste the link to your live Google doc in the box below)

<https://docs.google.com/document/d/1ptEhnYHniNtT1yxDPcvXK7LpJaPGzi80BCSGZZhom7Y/edit?usp=sharing>

THE END