Rates and Probability with Solutions – Draft 2

1. Pollsters nowadays contact people with both landlines and cellphones. See the chart below and answer the following questions.

	Cellphone Owner	No Cellphone (landline owner)	Total
Under 25	600	100	700
25 or over	260	320	580
Total	860	420	1280

(Note: answers are rounded to nearest tenth of a percent)

Note for Dara: students fill in the numbers in orange in the chart

If a person is selected at random from those polled, determine the probability that:

a) a cellphone owner is selected

Possible Answers: a) 60.1% b) 62.5% **c) 67.2%** d) 70.3% e) 72. 7%

Hint: $\frac{\#\text{ cellphone owners}}{\text{total number surveyed}}$

Full Solution:

$$\frac{\#\text{ cellphone owners}}{\text{total number surveyed}} = \frac{860}{1280} \doteq 67.2\%$$

b) a person under 25 is selected

Possible Answers: a) 50.1% b) 52.4 % c) 53.6% **d) 54.7%** e) 55.1%

Hint: $\frac{\#\text{ under 25}}{\text{total number surveyed}}$

Full Solution:

$$\frac{\#\text{ under 25}}{\text{total number surveyed}} = \frac{700}{1280} \doteq 54.7\%$$

c) a person under 25 and a cellphone owner is selected

Possible Answers: **a) 46.9%** b) 48.3% c) 50.1% d) 53.4% e) 55.2%

Hint: $\frac{\#\text{ under 25 and also a cell phone owner}}{\text{total number surveyed}}$

Full Solution: $\frac{\#\text{ under 25 AND also a cell phone owner}}{\text{total number surveyed}} = \frac{600}{1280} \doteq 46.9\%$

d) a person over 25 **or** a cellphone owner is selected

Possible Answers: a) 87.2% b) 89.1 % **c) 92.2%** d) 93.7% e) 95.1%

Hint:

Indirect method: look for the only people who are NOT included

Direct Method: look for cell phone owner less than 25, cell phone owner more than 25 and non-cell phone owner over 25

Full Solution:

Solution for indirect method: $= \frac{1280 - 100}{1280} \doteq 92.2\%$

Solution for direct method: $\frac{600 + 260 + 320}{1280} = \frac{1180}{1280} = 92.2\%$

e) the person is over 25, given that (s)he is a landline owner

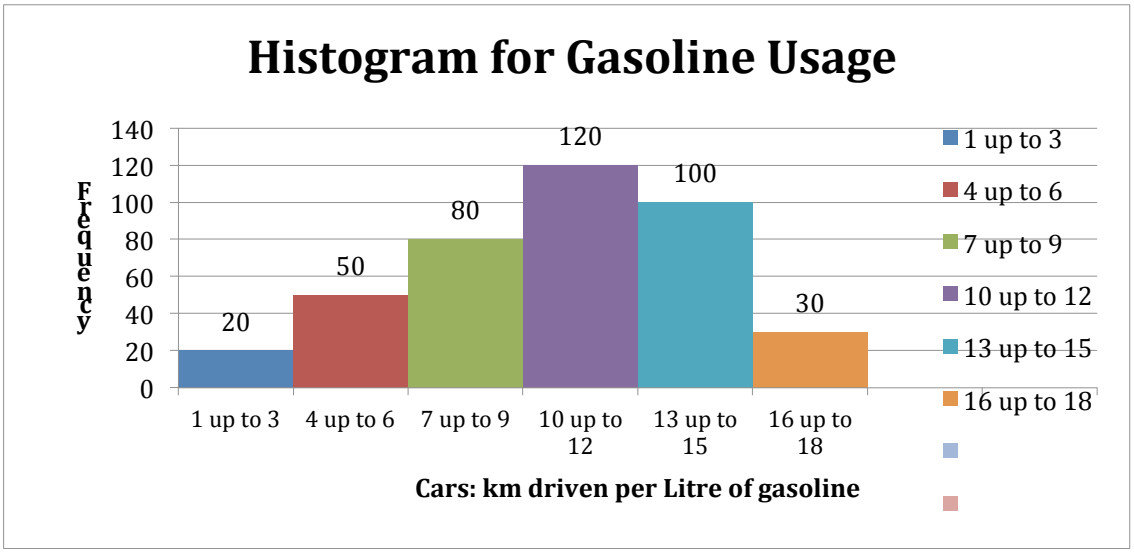
Possible answers: a) 70.2 % b) 71.8% c) 73.4% d) 75. 5% **e) 76.2%**

Hint: $\frac{\#\text{ who are landline owners and are over 25}}{\#\text{ who are landline owner}}$

Full Solution:

$\frac{\#\text{ who are landline owner and are over 25}}{\#\text{ who are landline owner}} = \frac{320}{420} \doteq 76.2\%$

2. Gas prices are rising. Your editor wants you to write about how this is affecting car owners. The local car owners association gives you the following graph. Find the mean kilometers per litre used overall.



Possible Solutions: a) 10.0 **b) 10.4** c) 10.8 d) 11.2 e) 11.6

Hints: 1) find the midpoint of each range

2) $\dfrac{\text{total number of km driven}}{\text{sum of frequencies}}$

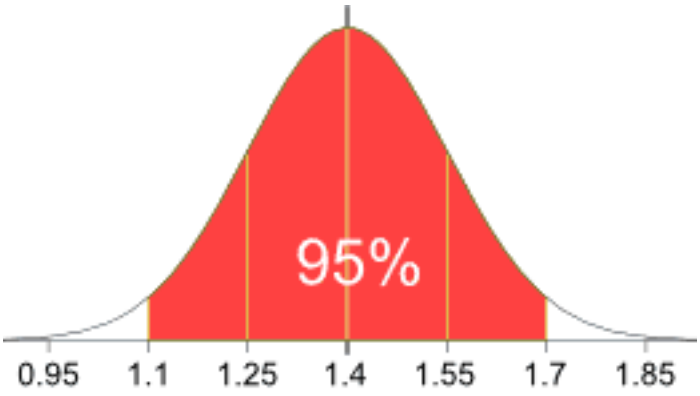
Full Solution:

$$\frac{\text{total number of km driven}}{\text{sum of frequencies}}$$

$$= \frac{(2)(20)+5(50)+8(80)+11(120)+14(100)+17(30)}{20+50+80+120+100+30}$$

$$= 10.4$$

3. It's been a rainy fall and your editor wants you to write a quick weather web hit. The local environmental info centre has given you some historical data on November precipitation. Using the graph below (where the x-axis represents monthly rainfall in November in Toronto), what is the probability that it rains more than 1.7 cm in November?



Choices: a) 5% b) 95% c) 97.5% d) **2.5%** e) 90%

Hint: Sum of the area under the curve = 100%

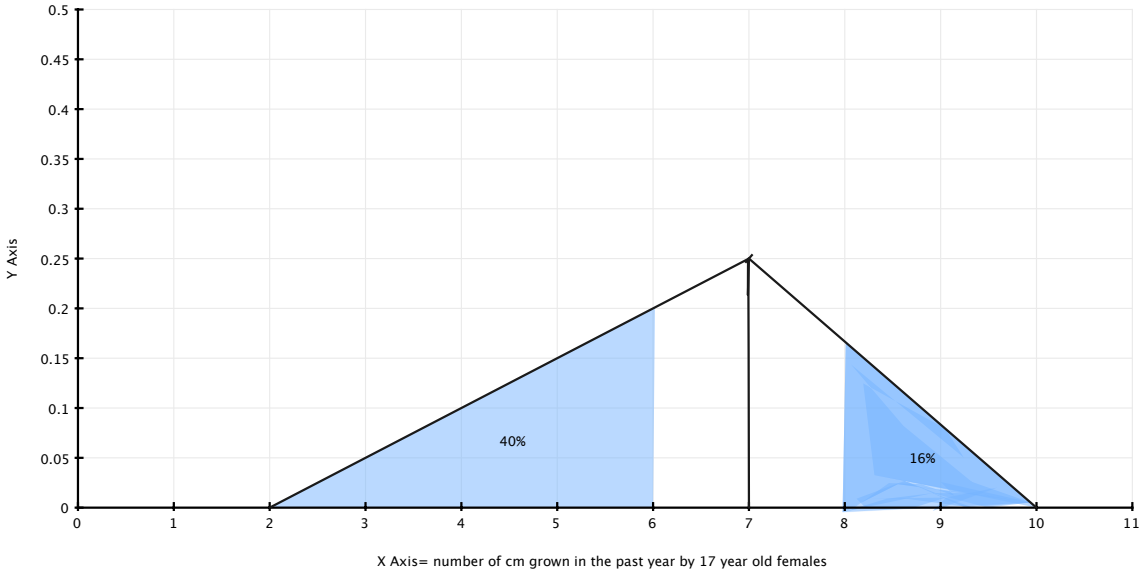
Full Solution:

P(Rain greater than 1.7 cm) = $\frac{100-95}{2}$

= 2.5%

Based on the information provided, 95% of the scores lie between 1.1 cm and 1.7 cm of rainfall. Since the graph is symmetric, 100%-95% = 5% remaining to be shared between two unshaded area. Therefore, each unshaded area = $\frac{5\%}{2} = 2.5\%$.

(Alternative to Question 3 above)
A biologist has discovered that teenage girls grow faster than teenage boys. In an interview, the biologist indicates the range of growth for a 17-year-old girl is between 6 cm and 8 cm a year. He then provides you with his data. Using the graph below, determine the probability that a 17-year-old female grows between 6 cm and 8 cm in one year.



Possible answers: a)40% b) 56% c) **44%** d) 16% e) 60%

Hint: Sum of the area under the curve = 100%

Full Solution:
P(6 < female < 8) = 100% - 40% - 16%
= 44 %

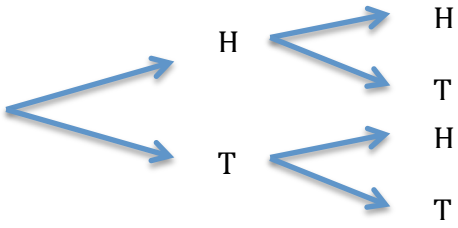
Based on the information provided, sum of the area of the shaded region = 40% + 16% = 56%. The unshaded region = 100% - 56% = 44%.

4. In tossing two coins, what is the probability of getting 2 heads?

a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) $\frac{1}{5}$

Hint: Think "Tree Diagram"

Full Solutions:
Tree Diagram: Total Possible Outcomes



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Therefore, P(2 heads) = $\frac{1}{4}$

Alternative ending to Question 4 above:

What is the probability of getting 2 tails?
What is the probability of getting a head and a tail?
What is the probability of getting a head first followed by a tail?
What is the probability of getting a tail first followed by a head?

Alternative question to #4 above:
In tossing three coins, what is the probability of getting 3 heads?

Alternative ending to tossing three coins:
What is the probability of getting 3 tails?
What is the probability of getting exactly 2 heads?
What is the probability of getting exactly 2 tails?
What is the probability of getting a head followed by two tails?
What is the probability of getting a head, a tail and a head in that order?
What is the probability of getting a tail, a head and a tail in that order?

5. You've been asked to cover the national spelling bee, but you've missed two of the results. One of the contestants, Lui, participated in seven rounds of the bee. Each round consisted of 12 words.

You only have the results from five rounds. The results were: 9,5,7,9 and 10.

You found out the mode was 9 and the mean was 8. Knowing that the worst result was a 5, what are the two missing results?

a) 6,10 b) 5,9 **c) 7,9** d) 6, 7 e) 7, 8

Hint: Total Score = Average Score $\times$ Total # of Scores

Full Solutions:

Her average score is 8 so that means

$Total$ on all 7 tests $= (8)(7) = 56$

Adding the four tests we have so far $= 9+5+7+9+10 = 40$

If we let the other two test scores be x, y

$x + y = 56 - 40$

$x + y = 16$

So that rules out answers b) d) and e)

But the unique mode is 9 so we can't have a test yield a score of

$5, 7, or$ 10 without achieving another 9.

This rules out answer a) as then it would be bimodal.

So the answer is 7,9 which still makes 9 the unique mode.

Alternative to Question 5 above:

You have done some research for an article on vacation time. Your research has found the following information given.

In days, the mean was 16 and the median was 18 and there is a single mode (not bimodal). There were 10 people in the data sample provided. Here is the data sample but unfortunately two of the 10 pieces of data have been inadvertently erased.

It is known that the minimum number of days of vacation is at least 5 days. Use this information to determine the values missing denoted by x and y.
24, 12, 24, 15, 18, 18, 19, 5, x , y

Possible answers:
a) 12, 12 b) 15,9 c) 16,8 d) 18, 6 e) Cannot be determined

Hint: Total Score = Average Score $\times$ Total # of Scores

Full Solutions:

The average vacation time is 16 so that means

$Total$ on all 10 results $= (16)(10) = 160$

Adding the eight vacation statistics we have so far $= 5+12+15+18+18+19+24+24 = 135$

If we let the other statistics be x, y

$x + y = 160 - 135$

$x + y = 25$

Since the sum of each pair of numbers in a) through d) is 24, e) is the correct choice. Answers cannot be determined.