Class Exercise - Solutions

1. **Multiple Choice**

For each question below, select **all** the statements that are **correct**. Each question has **at least one correct answer, but not necessarily all options are correct**. You will receive **full credit** if and only if you select all correct answers and **no incorrect answers**. Selecting an incorrect option or missing a correct option may result in **partial credit or no credit**.

Solution

Incorrect statement(s) are in struck out

A. Which of the following statements about **probability** are true?
   a. Probability quantifies the likelihood of an event occurring.
   b. Probability is always a number between 0 and 1, inclusive.
   c. In repeated trials, probability connects to the long-run relative frequency of an event.
   d. ~~Probability tells us with certainty what will happen in a single trial.~~
   e. ~~Probability is unrelated to empirical data.~~

B. Which of the following statements about a **random event** are true?
   a. A random event is an occurrence whose outcome cannot be predicted with certainty in advance.
   b. ~~A random event must have all outcomes equally likely.~~
   c. A random event can be assigned probabilities via a model or empirical evidence.
   d. ~~A random event is the same thing as the sample space.~~
   e. A random event's outcome is governed by chance mechanisms not fully under our control.

C. Which statements best describe the **goals of statistics**?
   a. To describe and summarize data in informative ways.
   b. To draw inferences about populations from samples and to quantify uncertainty.
   c. ~~To guarantee that our conclusions are always correct.~~
   d. ~~To prove causal relationships from observational data without additional assumptions.~~
   e. To support decision-making under uncertainty using data and models.

2. **Trumpillar**

Never touch anything that looks like Donald Trump's hair. Scientists have nicknamed this caterpillar the 'Trumpapillar'. Its barbs can cause painful irritation, and it is said to be more venomous than its namesake.

Below are the **lengths** (in millimetres) of 40 Trumpapillars (real name *Megalopyge opercularis* aka Southern Flannel Moth)

$$
\begin{array}{cccccccccc}
18 & 18 & 18 & 18 & 19 & 20 & 20 & 21 & 21 & 22 \\
24 & 24 & 25 & 25 & 25 & 25 & 26 & 26 & 31 & 31 \\
32 & 34 & 35 & 35 & 35 & 36 & 36 & 37 & 38 & 38 \\
39 & 40 & 40 & 41 & 41 & 41 & 42 & 43 & 43 & 45
\end{array}
$$

(a) Organize the data using **seven classes** into a table showing the: class limits, class boundaries, the frequencies, relative frequencies, the less-than cumulative frequencies (LTCF), the LTCF's in decimal, the more-than cumulative frequencies (MTCF), and the MTCF's in decimal.

Solution

Class Limits	Class Boundaries	Freq.	Rel. Freq.	LTCF	LTCF (dec.)	MTCF	MTCF (dec.)
$18 - 21$	$17.5 - 21.5$	9	0.225	9	0.225	40	1.000
$22 - 25$	$21.5 - 26.5$	7	0.175	16	0.400	31	0.775
$26 - 29$	$25.5 - 29.5$	2	0.050	18	0.450	24	0.600
$30 - 33$	$29.5 - 33.5$	3	0.075	21	0.525	22	0.550
$34 - 37$	$33.5 - 37.5$	7	0.175	28	0.700	19	0.475
$38 - 41$	$37.5 - 41.5$	8	0.200	36	0.900	12	0.300
$42 - 45$	$41.5 - 45.5$	4	0.100	40	1.000	4	0.100
		40					

(b) What is the probability that a randomly selected Trumpapillar has a length of at least 34 mm?

Solution: $\frac{19}{40} = 0.475$

(c) What is the probability that a randomly selected Trumpapillar has a length at most 25 mm or at least 42 mm?

Solution: $\frac{16}{60} + \frac{4}{40} = \frac{20}{40} = 0.500$

(d) What is the probability that a randomly selected Trumpapillar is between 30 mm and 41 mm (inclusive)?

Solution: $\frac{3+7+8}{40} = \frac{18}{40} = 0.450$