Class Exercise 1 - Solutions

1. **Matt Damon**

The total cost of rescuing a stranded Matt Damon in all of his films (including Saving Private Ryan, Interstellar and The Martian) is an estimated $900 billion. The run times (in minutes) for 40 movies where Matt Damon needed to be rescued are shown below:

104	110	112	120	126	128	130	130	135	136
138	139	141	142	143	144	147	151	152	152
155	157	158	158	159	159	161	163	163	163
166	167	168	169	169	169	171	172	174	174

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

Solution

$$Class\,width = \frac{Highest - Lowest}{Number\,of\,classes} = \frac{174 - 104}{7} = 10 \quad \Rightarrow \quad 11$$

Class Limits	Class Boundaries	Freq.	Rel. Freq	LTCF	LTCF (dec.)	MTCF	MTCF (dec.)
$104 - 114$	$103.5 - 114.5$	3	0.0750	3	0.0750	40	1.0000
$115 - 125$	$114.5 - 125.5$	1	0.0250	4	0.1000	37	0.9250
$126 - 136$	$125.5 - 136.5$	6	0.1500	10	0.2500	36	0.9000
$137 - 147$	$136.5 - 147.5$	7	0.1750	17	0.4250	30	0.7500
$148 - 158$	$147.5 - 158.5$	7	0.1750	24	0.6000	23	0.5750
$159 - 169$	$158.5 - 169.5$	12	0.3000	36	0.9000	16	0.4000
$170 - 180$	$169.5 - 180.5$	4	0.1000	40	1.0000	4	0.1000
		40					

(b) What is the probability that a randomly Matt Damon film has a runtime of at least 148 minutes?

Solution

Let X = the run time of a Matt Damon movie

$$P(X \geq 148) = \frac{23}{40} = 0.575$$

(c) What is the probability that a randomly selected Matt Damon film has a runtime of 126 to 158 minutes (inclusive)?

Solution

$$P(126 \leq X \leq 188) = \frac{6+7+7}{40} = \frac{20}{40} = 0.500$$

(d) What is the probability that the runtime of a randomly selected Matt Damon film is at most 125 minutes or is at least 170 minutes?

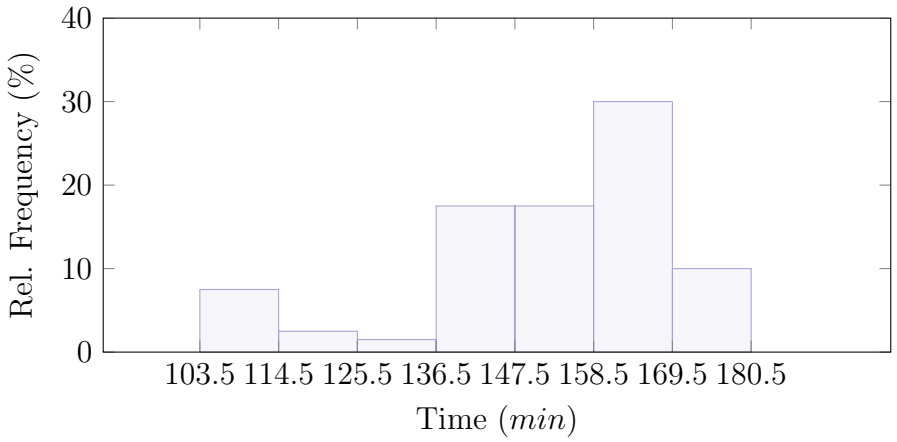
Solution

$$\begin{aligned} P(X \leq 125 \text{ or } X \geq 170) &= P(X \leq 125) + P(X \geq 170) \\ &= \frac{3+1}{40} + \frac{4}{40} \\ &= \frac{8}{40} = 0.2000 \end{aligned}$$

(e) Decide between a bar chart and a histogram. Then sketch the graph of the relative frequencies (in percentages) for the run times of movies when Matt Damon needed to be rescued. Label your axes and comment on the shape of the graph (uniform, unimdoal, bimodal, skewed-left, skewed-right, symmetric, ...)

Solution

$\because$ time is a continuous random variable $\Rightarrow$ histogram.



Comment: The distribution is unimodal; skewed left.

2. **Are You Dead?**

The most downloaded paid app in China is targeted at people living alone and is called Are You Dead? If the user doesn't confirm that they are alive for two days, the app notifies their emergency contact.

A researcher is studying how many paid apps people who live alone typically have installed on their phones, since apparently silence, like premium features, costs extra.Below are the numbers of paid apps found on 45 randomly selected phones (all owners live alone):

5	5	6	6	6	7	7	7	7	8	8	8	9	9	9
10	10	10	11	11	12	12	12	13	13	14	15	15	15	16
17	18	19	20	21	22	24	26	28	30	32	35	38	42	48

(a) Organize the data using **six 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

$$Class\,width = \frac{Highest - Lowest}{Number\,of\,classes} = \frac{48-5}{6} = 7.1667 \quad \Rightarrow \quad 8$$

Class Limits	Class Boundaries	Freq.	Rel. Freq (dec.)	LTCF	LTCF (dec.)	MTCF	MTCF (dec.)
$5-12$	$4.5-12.5$	23	0.5111	23	0.5111	45	1.0000
$13-20$	$12.5-20.5$	11	0.2444	34	0.7556	22	0.4889
$21-28$	$20.5-28.5$	5	0.1111	39	0.8667	11	0.2444
$29-36$	$28.5-36.5$	3	0.0667	42	0.9333	6	0.1333
$37-44$	$36.5-44.5$	2	0.0444	44	0.9778	3	0.0667
$45-52$	$44.5-52.5$	1	0.0222	45	1.0000	1	0.0222
		45					

(b) What is the probability that a randomly selected phone has most 20 paid apps installed?

Solution

Let X = the number of paid apps on a phone.

$$P(X \leq 20) = \frac{34}{45} = 0.7556$$

(c) What is the probability that a randomly selected phone has 37 or more paid apps installed?

Solution

$$P(X \geq 37) = \frac{3}{45} = 0.067$$

(d) How many people have between 21 and 44 (inclusive) paid apps installed on their phones?

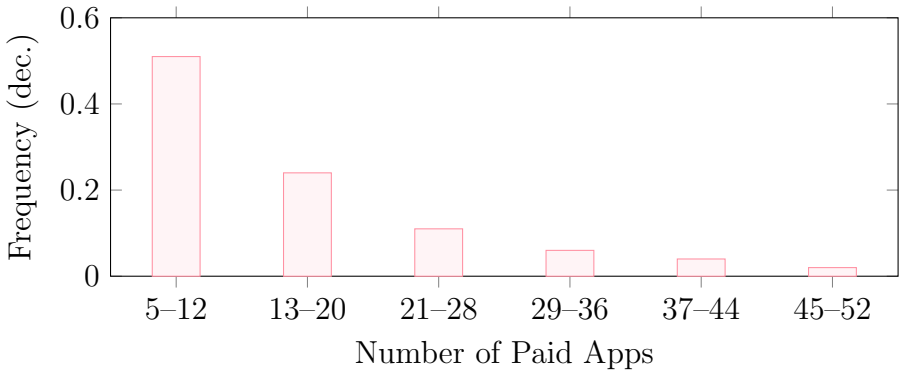
Solution

$$5 + 3 + 2 = 10$$

(e) Decide between a bar chart and a histogram. Then sketch the graph of the relative frequencies (in decimal) for the number of paid apps these individuals have on their phones. Label the axes and comment on the shape and characteristics of the graph.

Solution

$\because$ the number of paid apps is a **discrete** variable $\Rightarrow$ **bar chart**.



Comment: The distribution is unimodal; skewed right.