L1. Presentation of Data

Example 1: Volcano Vents

In May of 2018, Hawaii's Mount Kilauea's lava forced 17,000 to evacuate; but locals still asked the US Geological Survey if they could roast marshmallows on volcanic vents. The answer was no, unless you like poison-gas and sulphuric acid on your snacks. Someone then asked if the vents were suitable for roasting hot dogs [a] .

Sixty residents were asked how much they had spent on hot-dogs and marshmallows last May. Their responses rounded to the nearest dollar are shown below.

90	92	92	93	95	95	96	96	97	98	98	100	102	103	104
104	104	107	107	108	109	111	112	114	114	115	119	120	120	122
123	126	128	129	129	132	134	134	135	136	137	137	139	139	139
139	140	140	140	141	141	141	144	144	145	145	146	146	147	150

a. Divide the data into seven classes and construct a table showing the: class limits, class boundaries, frequencies, relative frequencies, less-than cumulative frequencies, and more-than cumulative frequencies.

b. The most frequently occurring category contained _____ Hawaiian residents. They spent between _____ and _____ on marshmallows and hot-dogs last May.

c. What is the probability that a randomly selected person spent at least \$126 on hot-dogs?

d. What is the probability that a randomly selected person spent \$116 or less on hot-dogs?

[a] https://time.com/5293693/kilauea-volcano-usgs-marshmallow/

Solution

a. Class width

$$CW = \frac{Largest\,value - Smallest\,value}{\#\,of\,classes} = \frac{150 - 90}{7} = 8.571 \quad \Rightarrow \quad 9$$

Table:

Class Limits	Class Boundaries	Freq.	Rel. Freq.	LTCF	MTCF
90 – 98	89.5 – 98.5	11	0.1833	11	60
99 – 107	98.5 – 107.5	8	0.1333	19	49
108 – 116	107.5 – 116.5	7	0.1167	26	41
117 – 125	116.5 – 125.5	5	0.0833	31	34
126 – 134	125.5 – 134.5	7	0.1167	38	29
135 – 143	134.5 – 143.5	14	0.2333	52	22
144 – 152	143.5 – 152.5	8	0.1333	60	8
		60			

b. The most frequently occurring category contained **14** Hawaiian residents. They spent between **\$135** and **\$143** on marshmallows and hot-dogs last May.

c. Let X = the amount spent on hot-dogs last month

$$P(X \geq 126) = \frac{29}{60} = 0.4833$$

d. Let X = the amount spent on hot-dogs last month

$$P(X \leq 166) = \frac{265}{60} = \frac{13}{30} = 0.4233$$

Example 2: Landscape in Snow

To jazz up the White House, Donald Trump asked the Guggenheim to lend him Van Gogh's "Landscape with Snow." The museum declined; and offered to send a gold toilet instead! The White House never responded to the museum's counteroffer [a].

The amount of time in seconds, that thirty visitors spent admiring Van Gogh's "Landscape with Snow" is shown below.

189	191	263	265	272	274	275	292	336	351
375	400	414	418	423	426	430	445	447	474
477	493	513	520	557	558	565	568	589	592

a. Divide the data into six classes and construct a table showing the: class limits, class boundaries, frequencies, relative frequencies, less-than cumulative frequencies, and more-than cumulative frequencies.

b. What is the probability that a randomly selected visitor spent 393 seconds or more looking at the painting?

c. What is the probability that a randomly selected visitor spent at most 324 seconds or less, looking at the painting?

d. What is the probability that a randomly selected person spent either at most 256 seconds or at least 461 second looking at the painting?

e. Sketch the frequency distribution for the data.

[a]https://www.culturedmag.com/article/2023/01/24/donald-trump-maurizio-cattelan-guggenheim-vincent-van-gogh

Solution

a. Class width

$$CW = \frac{Largest\,value - Smallest\,value}{\#\,of\,classes} = \frac{592 - 189}{6} = 67.1667 \quad \Rightarrow \quad 68$$

Table:

Class Limits	Class Boundaries	Freq.	Rel. Freq.	LTCF	MTCF
189 – 256	189.5 – 256.5	2	0.0667	2	30
257 – 324	256.5 – 324.5	6	0.2	8	28
325 – 392	324.5 – 392.5	3	0.1	11	22
393 – 460	392.5 – 460.5	8	0.2667	19	19
461 – 528	460.5 – 528.5	5	0.1667	24	11
529 – 596	528.5 – 596.5	6	0.2	30	6
		30			

b. Let X = the amount of time a visitor spent looking at the painting

$$P(X \geq 393) = \frac{19}{30} = 0.6333$$

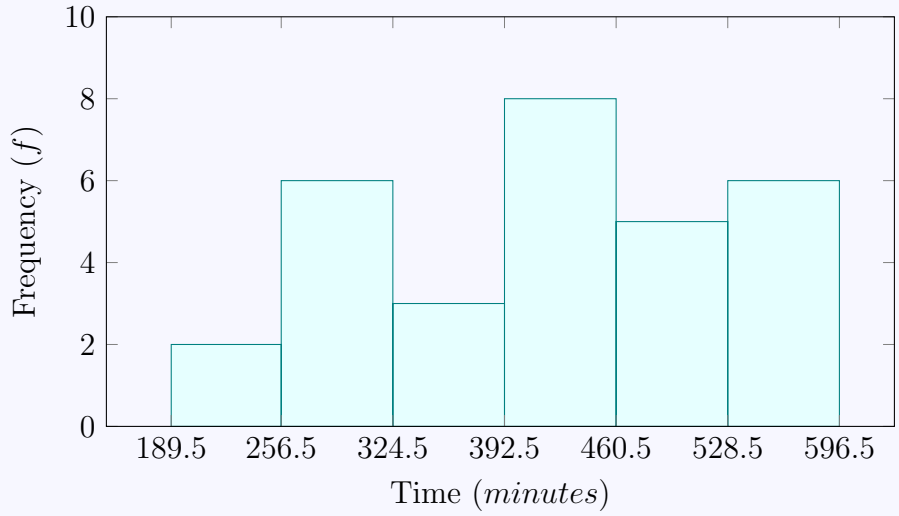
c. Let X = the amount of time a visitor spent looking at the painting

$$P(X \leq 324) = \frac{8}{30} = \frac{4}{15} = 0.2667$$

d. Let X = the amount of time a visitor spent looking at the painting

$$P(X \leq 256) + P(X \geq 461) = \frac{2}{30} + \frac{11}{30} = \frac{13}{30} = 0.4333$$

e. Graph of frequency distribution



Example 3: Vexations

'Vexations' (1893) is a piano piece by the composer Erik Satie that is supposed to be played very slowly 840 times. The first performance, conducted by John Cage in 1963, went for more than 18 hours. At the end, one audience member shouted 'Encore!'[a]

The time it takes in minutes for 30 people to learn to play Vexations is presented below:

62	63	65	68	74	81	83	84	85	87
94	97	98	110	116	117	117	123	125	127
131	136	140	140	155	155	156	164	171	178

a. Divide the data into seven classes and construct a table showing the: class limits, class boundaries, frequencies, relative frequencies, less-than cumulative frequencies, and more-than cumulative frequencies.

b. What is the probability that a randomly selected visitor spent at most 112 minutes learning to play the piece?

c. What is the probability that a randomly selected visitor spent at least 130 minutes learning to play Vexations?

d. How many people took between 164 to 180 minutes to learn the piece?

e. Sketch the more-than cumulative frequency (%) distribution.

[a] https://www.theguardian.com/music/2016/jun/25/erik-satie-vexations-furniture-music

Solution

a. Class width

$$CW = \frac{Largest\,value - Smallest\,value}{\#\,of\,classes} = \frac{178 - 62}{7} = 16.5714 \quad \Rightarrow \quad 17$$

Table:

Class Limits	Class Boundaries	Freq.	Rel. Freq.	LTCF	MTCF
62 – 78	61.5 – 78.5	5	0.0667	5	30
79 – 95	78.5 – 95.5	6	0.2	11	25
96 – 112	95.5 – 112.5	3	0.1	14	19
113 – 129	112.5 – 129.5	6	0.2	20	16
130 – 146	129.5 – 146.5	4	0.1333	24	10
147 – 165	146.5 – 165.5	3	0.1	27	6
164 – 180	165.5 – 180.5	3	0.1	30	3
		30			

b. Let X = the amount of time that it takes to learn the piece

$$P(X \leq 112) = \frac{14}{30} = \frac{7}{15} = 0.4667$$

c. Let X = the amount of time that it takes to learn the piece

$$P(X \geq 130) = \frac{10}{30} = \frac{1}{3} = 0.3333$$

d. Number of people who took between 164 to 180 minutes to learn the piece: 3

e. Graph of the more-than cumulative frequency distribution in percentages.

Here is the data table again with the more-than cumulative frequencies converted into percentages.

Class Limits	Class Boundaries	Freq.	MTCF	MCTF (%)
62 – 78	61.5 – 78.5	5	30	$\frac{30}{30} \times 100 = 100$
79 – 95	78.5 – 95.5	6	25	$\frac{25}{30} \times 100 = 83.33$
96 – 112	95.5 – 112.5	3	19	63.33
113 – 129	112.5 – 129.5	6	16	53.33
130 – 146	129.5 – 146.5	4	10	33.33
147 – 165	146.5 – 165.5	3	6	20
164 – 180	165.5 – 180.5	3	3	10
		30