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Winter 2020 Assignment 3

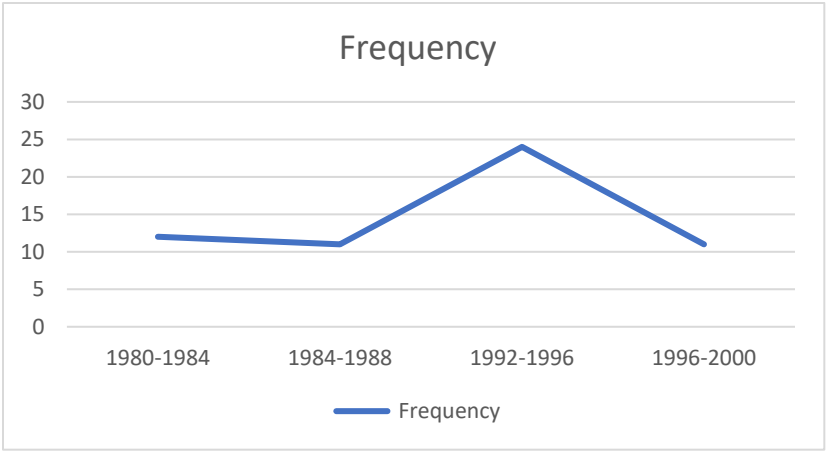
# COMP 233 Assignment 3

**Question 1:**

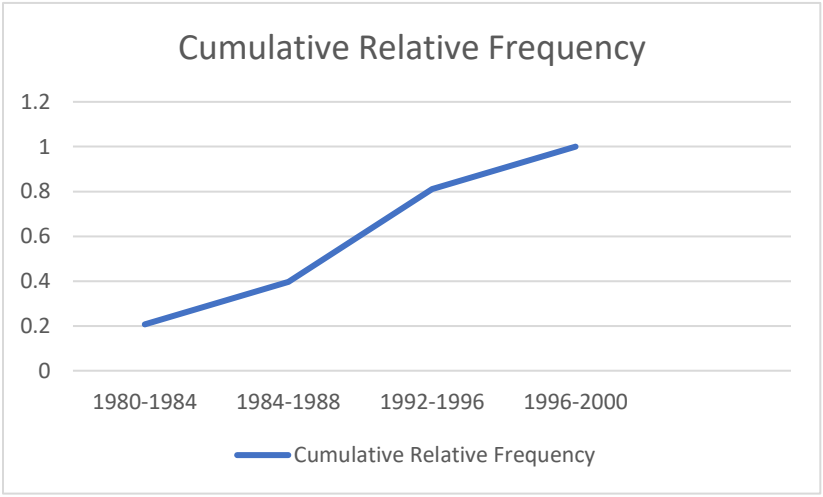
a) Number of classes $= \sqrt{16} = 4$, Range $= 1995 - 1980 = 15$, Width $= \frac{15}{4} = 3.75 \approx 4$.
Total $= 58$

| Year | Fatal accidents | Relative Frequency | Cumulative Relative Frequency |
|---|---|---|---|
| 1980-1984 | 12 | 0.2069 | 0.2069 |
| 1984-1988 | 11 | 0.1897 | 0.3966 |
| 1992-1996 | 24 | 0.4138 | 0.8103 |
| 1996-2000 | 11 | 0.1897 | 1.0000 |

b)




c)



d) Mean: $\mu = 3.625\ accidents/year$

e) Median: $\frac{4+3}{2} = 3.5$

f) Mode: 11

g) $Var(X) = \frac{\sigma^2}{n} = E(X^2) - E(X)^2 = 1201733510 - 115302^2 =$

**Question 2:**

a) Stem and leaf table:

| | |
|---|---|
| 3.4 | 6, 8, 9 |
| 3.5 | 0, 5, 6 |
| 3.6 | 1, 2, 5, 6, 7, 9 |
| 3.7 | 0, 1, 2, 2, 2, 4, 5, 9 |
| 3.8 | 0, 2, 3, 6, 7 |
| 3.9 | 0, 1, 3, 5, 6 |

b) 3.72067

c) 0.14567

d) $3.72067 \pm 1.5 \times 0.14567$

$\frac{24}{30} = 0.8 \rightarrow 80\%$

With Chebyshev's inequality:

$$= 100\left(1 - \frac{1}{k^2}\right) = 100\left(1 - \frac{1}{1.5^2}\right) = 100 * \frac{5}{9} = \frac{500}{9} = 55.55\%$$

e) $3.72067 \pm 2 \times 0.14322$

$\frac{30}{30} = 1 \rightarrow 100\%$

With Chebyshev's inequality:

$$= 100\left(1 - \frac{1}{k^2}\right) = 100\left(1 - \frac{1}{2^2}\right) = 100 * \frac{3}{4} = \frac{300}{4} = 75\%$$

**Question 3:**

a) Let Z be a std normal random variable

Using the central limit theorem, $\sigma = \frac{15}{\sqrt{25}} = 3$

$$P\{72 < \bar{X} < 82\} = P\left\{\frac{72-77}{3} < \frac{\bar{X}-77}{3} < \frac{82-77}{3}\right\}$$

$$= P\left\{-1.667 < \frac{\bar{X}-77}{3} < 1.667\right\} \rightarrow P\{-1.667 < Z < 1.667\}$$

$$\approx 2P\{Z < 1.667\} - 1 \approx 2(0.9515) - 1 \approx 0.903$$

b) Using the central limit theorem, $\sigma = \frac{15}{\sqrt{64}} = 1.875$

$$P\{72 < \bar{X} < 82\} = P\left\{\frac{72-77}{1.875} < \frac{\bar{X}-77}{1.875} < \frac{82-77}{1.875}\right\}$$

$$= P\left\{-2.667 < \frac{\bar{X} - 77}{1.875} < 2.667\right\} \rightarrow P\{-2.667 < Z < 2.667\}$$
$$\approx 2P\{Z < 2.667\} - 1 \approx 2(0.9961) - 1 \approx 0.9922$$

c) $P\{S^2 > 1.875\} = P\left\{\frac{n-1}{15^2}S^2 > \frac{n-1}{15^2}(1.875)\right\}$

$$P\{x_{24}^2 > 0.2\} = 1 - P\{x_{24}^2 < 0.2\} = 1$$

So we have 0% chance that group of 25 will have higher average than group of 64

d) The class of 25 has more chance of getting 83 as average. Because the higher group is more likely to be close to the mean.

**Question 4:**

**Question 5:**

Let X denote the students average score. Give each of the student a number and let $X_i$ denote the score of student i.

With n = 144, we have from the central limit theorem that $X = \sum_{i=1}^{n} X_i$

Will have a normal distribution with mean $517 \times 144 = 74{,}016$ and standard deviation= $120 \times \sqrt{144} = 1440$

a) $P\{X > 507\} = P\left\{\frac{X-74016}{1440} > \frac{507-74016}{1440}\right\} = P\{Z > -51.047916\} = P\{Z < 51.047916\}$

b) $P\{X > 517\} = P\left\{\frac{X-74016}{1440} > \frac{517-74016}{1440}\right\} = P\{Z > -51.040974\} = P\{Z < 51.040974\}$

c) $P\{X > 537\} = P\left\{\frac{X-74016}{1440} > \frac{537-74016}{1440}\right\} = P\{Z > -51.027084\} = P\{Z < 51.027084\}$

d) $P\{X > 550\} = P\left\{\frac{X-74016}{1440} > \frac{550-74016}{1440}\right\} = P\{Z > -51.018055\} = P\{Z < 51.018055\}$