Carleton University – Faculty of Engineering

ECOR 2050

Instructor: S. Shams | Assignment #1- Solutions | Due: W. Oct 02, 5:30 pm

SHOW ALL CALCULATIONS & CLEARLY STATE ANY/ALL ASSUMPTIONS!!!

1. (14 marks)

The following data are the measures of the diameters of 36 rivet heads in 1/100 of an inch.

6.72	*6.77*	*6.82*	*6.70*	*6.78*	*6.70*	*6.62*	*6.75*	*6.66*	*6.66*	*6.64*	*6.76*
6.73	*6.80*	*6.72*	*6.76*	*6.76*	*6.68*	*6.66*	*6.62*	*6.72*	*6.76*	*6.70*	*6.78*
6.76	*6.67*	*6.70*	*6.72*	*6.74*	*6.81*	*6.79*	*6.78*	*6.66*	*6.76*	*6.76*	*6.72*

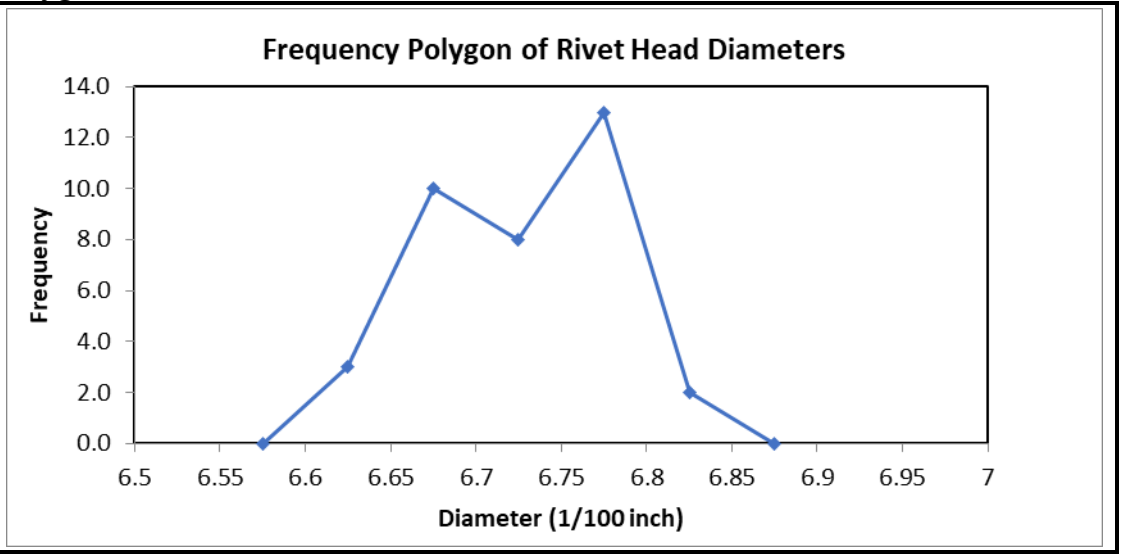
*a) Provide a **report-quality** frequency polygon of these data along with a table summarizing the grouped data.*

b) Compute the 10^{th} percentile of the sample.

c) Calculate the mean, variance, and coefficient of variation of the diameters.

a) Frequency Polygon

Interval	Freq.
6.55-6.6	0
6.6-6.65	3
6.65-6.7	10
6.7-6.75	8
6.75-6.8	13
6.8-6.85	2
6.85-6.9	0



b) $n = 36,\ p = 0.10,\quad (n+1)p = 3.7,\quad k = 3,\quad d = 0.7,\quad x_k = 6.64,\quad x_{k+1} = 6.66$

$Q_{0.10} = 6.64 + 0.7\cdot(6.66 - 6.64) = 6.654$ The 10th percentile is 6.654 hundredths of an inch.

c) $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_n \approx 6.726$ The sample mean diameter is 6.726 (1/100 inch).

$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2 \approx 0.002870$ The sample variance is 0.002870 (1/100 inch)^2.

$COV = \frac{s}{\bar{x}} \times 100\% \approx 0.7965\%$ The sample coefficient of variation is 0.7965%.

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2. (6 marks)

A collection of 7 artworks contains 2 non-original items. An art collector would like to by 3 artworks (by random) from this collection. X is the number of non-original items purchased by the art collector, and the probability distribution of X in tabular form is as follows:

x	0	1	2
$f(x)$	2/7	4/7	1/7

a) What is the probability X is greater than 0?

b) Find mean and variance of X.

Solution:

a)

$F(X > 0) = 1 - f(X \le 0) = 1 - \frac{2}{7} = \frac{5}{7}$

OR:

$F(X > 0) = F(X=1) + F(X=2) = 4/7 + 1/7 = 5/7$

b)

Mean: $E[X] = \sum xf(x) = (0)(\frac{2}{7}) + (1)(\frac{4}{7}) + (2)(\frac{1}{7}) = \frac{6}{7}$

Variance: $VAR[X] = E[X^2] - (E[X])^2 = (0)(\frac{2}{7}) + (1)(\frac{4}{7}) + (4)(\frac{1}{7}) - (\frac{6}{7})^2 = \frac{20}{49}$

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3. (12 marks)
Given a normal distribution with $\mu = 30$ and $\sigma = 6$, find
(a) the normal curve area between $x = 32$ and $x = 41$;
(b) the value of x that has 80% of the normal curve area to the left;
(c) the two values of x that contain the middle 75% of the normal curve area.

Solution:

NORMAL, $\mu = 30$, $\sigma = 6$

a) $P(32 < X < 41) = P(Z < (41-30)/6) - P(Z < (32-30)/6)$

$= P(Z < 1.83) - P(Z < 0.33)$

$= 0.9664 - 0.6293$

$= 0.3371$ $\therefore P(32 < X < 41) = 0.3371$

b) $P(X < x) = 0.8 \rightarrow P(Z < (x-30)/6) = P(Z < 0.84)$

$\rightarrow x = 6(0.84)+30 = 35.04$ $\therefore 80^{th}$ percentile is 35.04

c) $P(X < x) = 0.125 \rightarrow P(Z < (x-30)/6)$

From z-table: z = -1.15

$\rightarrow x = 6(-1.15)+30 = 23.10$

$P(X < x) = 0.875 \rightarrow P(Z < (x-30)/6)$

From z-table: z = 1.15

$\rightarrow x = 6(1.15)+30 = 36.90$

$\therefore$ the middle 75% of the normal curve lies between $x = 23.10$ and $x = 36.90$

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4. (8 marks)
The average grade for an exam is 74, and the standard deviation is 7.
*Grades are curved to follow a normal distribution and 12% of the class are given **A** s.*
*a) What is the lowest possible **A** and the highest possible **B**?*
b) What is the 60^{th} percentile grade?

Solution

a) $P(X > x) = 0.12$

$P(X < x) = 1 - P(X > x) = 1 - 0.12 = 0.88$

$\rightarrow P(Z < (x-74)/7) = 0.88$

From z-table: $z = 1.18$

$\rightarrow x = 7(1.18) + 74 = 82.26$

Therefore, the lowest A is 83 and the highest B is 82.

b) $P(X < x) = 0.6$

$\rightarrow P(Z < (x-74)/7) = 0.6$

From z-table: $z = 0.25$

$\rightarrow x = 7(0.25) + 74 = 75.75$

Therefore, 60% of the grades are 75 or less.