BRAC UNIVERSITY
Inspiring Excellence

STA201 Assignment 2 Solution

Question 1
150 steel workshops have the following distribution of average number of workers in various hourly wage brackets:

Wage Bracket:	500 – 600	600 – 700	700 – 800	800 – 900	900 – 1000
Number of workshops:	17	28	72	21	12
Average Number of Workers per workshop:	15	11	9	6	5

Find the mean salary paid to the workers.

Wage Bracket	Number of Workshops	Average Number of Workers:	Mid value (x)	Total Number of workers in each wage bracket (f)	TOTAL income for each wage bracket (fx)
500 - 600	17	15	550	255	140250
600 - 700	28	11	650	308	200200
700 - 800	72	9	750	648	486000
800 - 900	21	6	850	126	107100
900 - 1000	12	5	950	60	57000
			Sum:	1397	990550

Mean = 990550/1397 = 709.055

Question 2
The mean of 120 observations was calculated to be 76. Later on, it was found that two observations were misread as 85 and 43 instead of 185 and 98. Find the correct mean.

Incorrect total = 120×76
Correct total = $(120\times76)-(85+43)+(185+98)$
$\therefore$ Correct mean = $(120\times76)-(85+43)+(185+98) / 120 = 77.29$

Question 3
The mean monthly salaries paid to 100 employees of a company were tk. 5000. The mean monthly salaries paid to male and female employees were tk. 5200 and tk. 4200 respectively. Determine the percentage of males and females employed by the company.

Let the number of Male is X
So the number of female is 100 – X

$\therefore$ $(5200 * X) + 4200(100 - X) = 5000 * 100 \Rightarrow X = 80$
$\therefore$ Percentage of male: 80/100 *100 = 80%
$\therefore$ Percentage of female: 20/100 *100 = 20%

Question 4

A group of friends are going on a day out to Project Hilsha. They divided their route into 3 equal parts, and planned on maintaining an average speed of 68 km/h on their way to their destination. Their speed for the first and second part were 72 km/h and 88 km/h respectively. What speed should they maintain for the third part of their journey if they are to achieve their target average speed?

Using Harmonic Mean:
$HM = n/(1/s_1 + 1/s_2 + 1/s_3)$
$\therefore 68 = 3/\{1/72 + 1/88 + 1/s_3\}$
$\therefore s_3 = 53.0079$ km/hr

They should maintain a speed of 53.0079 km/h for the third part of their journey

Question 5

Let's assume you bought a new car with Tk. 3,500,000. The car depreciates in value by 40% after the first year, 20% after the second year, and 10% after the third year onward. What is the average rate of depreciation per year after three years? Therefore, what will be the value of the car after three years of use?

Using Geometric Mean:
Average rate of depreciation per year after 3 years: (0.6*0.8*0.9)^(1/3) = 0.7559
Value of car after 3 years: 35,00,000*(0.7559)^3 = 35,00,000*0.6*0.8*0.9 = Tk 1512000

Question 6

A study on a range of automotive lubricants reported the following data on oxidation-induction time (min) for various commercial oils:

Oxidation-Induction Time:	87	103	130	160	180	195	132	145	211	105
	145	153	152	138	87	99	93	119	129	

a. Calculate the sample variance and standard deviation for the oxidation-induction time.
b. If the observations were converted and displayed in hours, what would be the resulting values of the sample variance and sample standard deviation? Answer without actually performing the conversion.

[TABLE ON NEXT PAGE]

a. Sample variance, $s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{N} x_i^2 - \frac{(\sum_{i=1}^{N} x_i)^2}{N}\right] = \frac{1}{19-1}\left[368501 - \frac{(2563)^2}{19}\right] = 1264.766$

Standard deviation, $s = \sqrt{1264.766} = 35.564$

b. If the observations were to be converted and displayed in hours, then all the observations would have been divided by 60.

Hence, the sample variance = $\frac{1264.766}{60*60} = 0.351$

Standard deviation = $\sqrt{0.351} = 0.592$

x_i	x_i^2
87	7569
103	10609
130	16900
160	25600
180	32400
195	38025
132	17424
145	21025
211	44521
105	11025
145	21025
153	23409
152	23104
138	19044
87	7569
99	9801
93	8649
119	14161
129	16641
$\sum x_i = 2563$	$\sum x_i^2 = 368501$

Question 7
Blood cocaine concentration (mg/L) was determined both for a sample of individuals who had died from cocaine-induced excited delirium (ED) and for a sample of those who had died from a cocaine overdose without excited delirium; survival time for people in both groups was at most 6 hours.

ED:	0	0	0	0	0.1	0.1	0.1	0.1	0.2	0.2
	0.3	0.3	0.3	0.4	0.5	0.7	0.8	1	1.5	2.7
	2.8	3.5	4	8.9	9.2	11.7	21			

Non-ED:	0	0	0	0	0	0.1	0.1	0.1	0.1	0.2
	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.6	0.8
	0.9	1	1.2	1.4	1.5	1.7	2	3.2	3.5	4.1
	4.3	4.8	5	5.6	5.9	6	6.4	7.9	8.3	8.7
	9.1	9.6	9.9	11	11.5	12.2	12.7	14	16.6	17.8

a. Determine the three quartile values for blood cocaine concentration for both ED and Non-ED samples.
b. Construct a comparative boxplot (two boxplots on the same set of axes, one above the other), and use it as a basis for comparing and contrasting the ED and non-ED samples.

a) For ED samples,

n=27

First quartile, Q_1= ¼ * 27 = 6.75(7th value) = 0.1
Second quartile, Q_2= 2/4 * 27 = 13.5(14th value) = 0.4
Third quartile, Q_3= ¾ * 27 = 20.25(21st value) = 2.8

For non-ED samples,

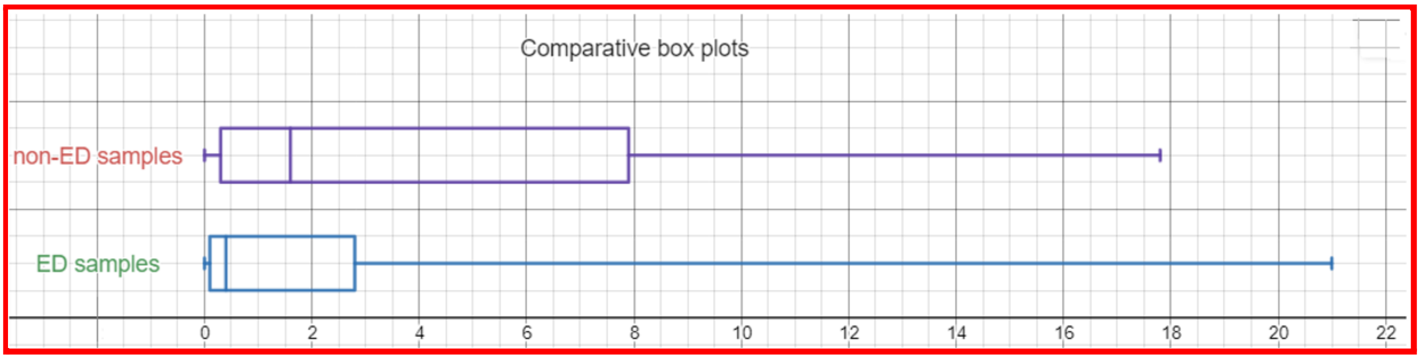
n=50

First quartile, Q_1= ¼ * 50 = 12.5(13th value) = 0.3
Second quartile, Q_2= 2/4 * 50 = 25(Average of 25th and 26th observations) = 1.6
Third quartile, Q_3= ¾ * 50 = 37.5(38th value) = 7.9

b) For ED samples,
Minimum value = 0
Maximum value = 21
Q_1=0.1
Q_2=0.4
Q_3=2.8

For non-ED samples,
Minimum value = 0
Maximum value = 17.8
Q_1=0.3
Q_2=1.6
Q_3=7.9

[BOX-PLOT ON NEXT PAGE]



Comparison between the boxplots:

- Range of ED samples greater than non-ED samples
- The interquartile range of ED samples is less than the interquartile range of non-ED samples
- The middle 50% of the observations of ED samples are more concentrated towards the median than that of the non-ED samples since ED samples have a lower interquartile range than non-ED samples
- Both box plots show a positively skewed distribution as Q_3-Q_2>Q_2-Q_1. However, non-ED samples are more positively skewed.