

Question 1 :- The data in the table are taken from a survey of the diet of 1308 men & 1540 women total 2848....

Ans (a) Mean: fresh vegetable:

$$\text{men: } \frac{(264 + 259 + 266 + 317)}{4}$$

$$= 261.5$$

$$\text{women: } \frac{(178 + 235 + 266 + 304)}{4}$$

$$= 245.75 = 245.8$$

Mean: fruit:

$$\text{men: } \frac{(31 + 45 + 69 + 105)}{4}$$

$$= 62.5$$

$$\text{women: } \frac{(28 + 46 + 70 + 121)}{4}$$

$$= 66.25 = 66.3$$

Mean: rice:

$$\text{men: } \frac{(367 + 337 + 269 + 246)}{4}$$

$$= 304.75 = 304.8$$

$$\text{women: } \frac{(315 + 276 + 243 + 220)}{4}$$

$$= 263.5$$

Mean: fish:

$$\text{men: } \frac{(23 + 28 + 31 + 44)}{4}$$

$$= 31.5$$

$$\text{women: } \frac{(19 + 21 + 28 + 46)}{4}$$

$$= 28.5$$

Ans 1 a) Mean: Meat : $\left(\frac{70 + 61 + 69 + 77}{4} \right)$

conti...

$$\text{men} = 69.25 = 69.3$$

$$\text{women} = \left(\frac{48 + 43 + 54 + 63}{4} \right)$$

$$= 52$$

now to find out the standard deviation or SD
we will multiply SE with total number of men
and women = $SE \times \sqrt{\text{men}}$ or $SE \times \sqrt{\text{women}}$

SD of Fresh vegetable : men : $0.9 \times \sqrt{1308} = 32.5$

$$= 32.5 \text{ for men}$$

$$\text{women} : 0.8 \times \sqrt{1540}$$

$$= 31.4 \text{ for women}$$

SD of Fruit : men : $0.5 \times \sqrt{1308}$

$$= 18.08 = 18.1$$

$$\text{women} = 0.4 \times \sqrt{1540}$$

$$= 15.69 = 15.7$$

SD of Rice : men : $1.0 \times \sqrt{1308}$

$$= 36.17 = 36.2$$

$$\text{women} = 0.8 \times \sqrt{1540}$$

$$= 31.4$$

SD of fish : men : $0.2 \times \sqrt{1308}$

$$= 7.23 = 7.2$$

$$\text{women} = 0.2 \times \sqrt{1540}$$

$$= 7.84 = 7.8$$

Ans 1a) sq of Meat: men: $0.4 \times \sqrt{1308}$
 conti... $= 14.46 = 14.5$

women: $0.3 \times \sqrt{1540}$
 $= 11.77 = 11.8$

To calculate the overall mean combined we multiply the total number of men with the mean adding with the total number of women and the mean dividing with the total of both

$$= \frac{(1038 \text{ (men)} \times \text{mean}) + (1540 \text{ (women)} \times \text{mean})}{2848}$$

overall mean
for fresh vegetables: $\frac{(1308 \times 261.5) + (1540 \times 245.8)}{2848}$
 $= 253.0$

overall mean : $\frac{(1308 \times 62.5) + (1540 \times 66.25)}{2848}$
for fruit
 $= 64.53$

overall mean : $\frac{(1308 \times 304.75) + (1540 \times 263.5)}{2848}$
of rice

$$= 282.44$$

overall mean : $\frac{(1308 \times 31.5) + (1540 \times 28.5)}{2848}$
of fish
 $= 29.88$

overall mean : $\frac{(1308 \times 69.25) + (1540 \times 52)}{2848}$
of meat
 $= 59.92$

Ans 1b) Milk consumption in both men and women in Q3 and Q4 but rises sharply in Q2 and Q1. Similar indications can be seen in root vegetable consumption where in both gender group Q3 and Q4 show less consumption rate than Q2 and Q1.

High wheat flour consumers can be found in Q1 and Q2 group with lesser consumers in Q3 and Q4.

So those who eat more fresh vegetable consume much more milk, flour wheat, root vegetable than those who eat less fresh vegetable.

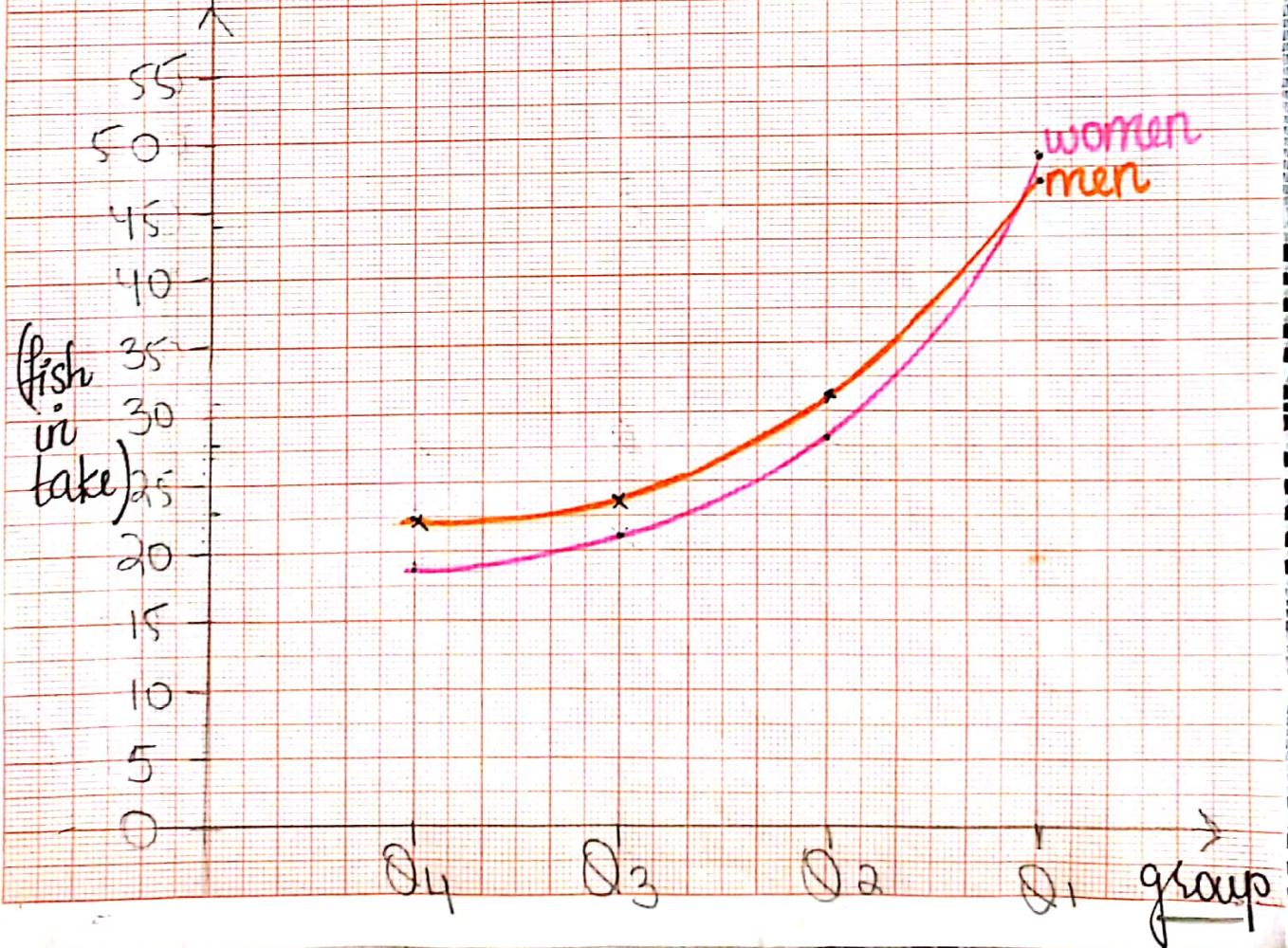
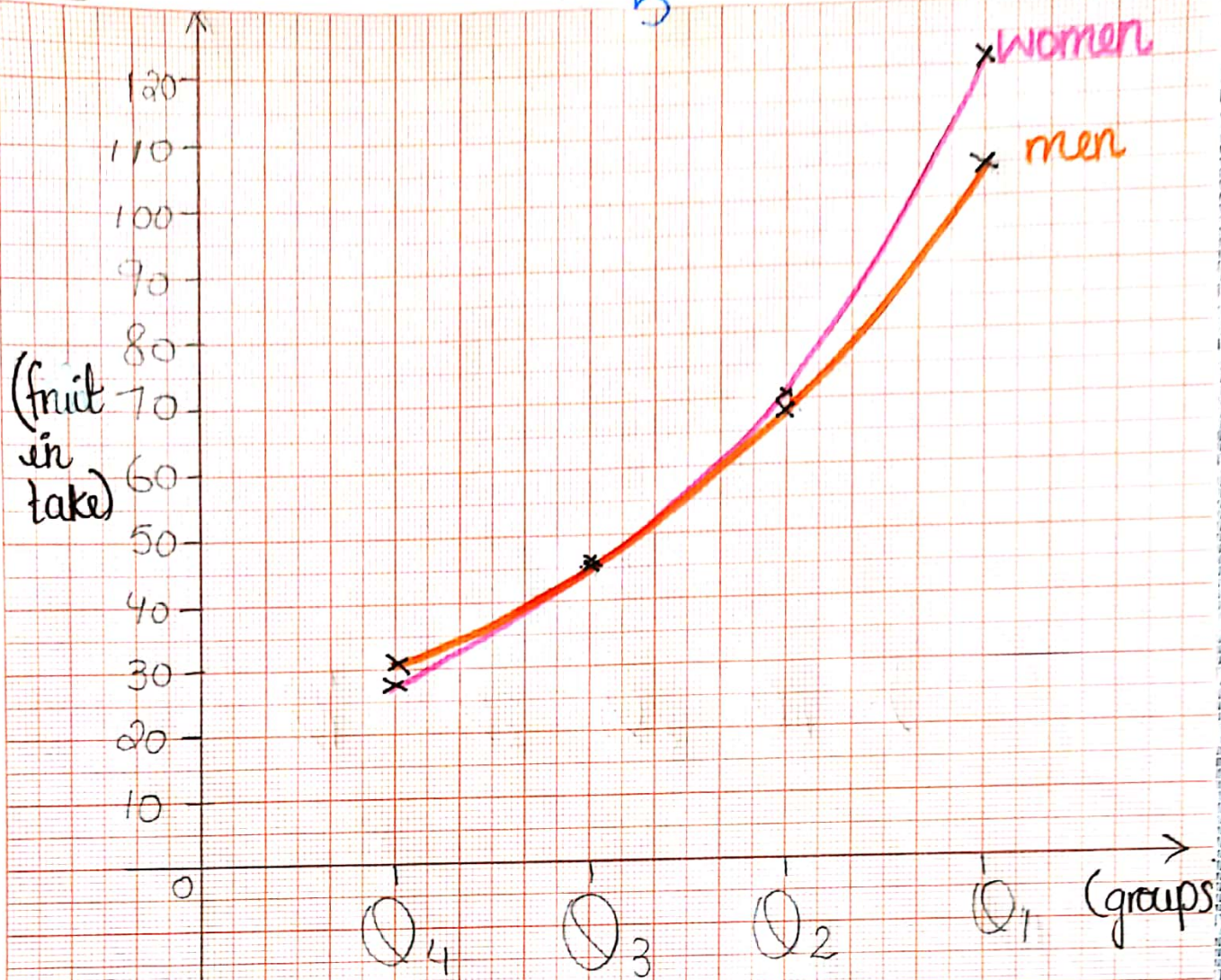
Ans 1c) Rice is the only food group that shows fall patterns in both men and for women as fresh vegetable consumption rises from Q4 to Q1.

Fruit category or food group shows a rise in its consumption in both men and women across Q4 to Q1.

Fish food group shows similar patterns of rise across group Q4 to Q1.

Ans 1d) To answer this following question two sets of graphs is drawn to compare fruit and fish intake / consumption in the 4 groups Q1, Q2, Q3, Q4 and comparing them accordingly.

(Graphs are drawn on the next page)



Ans (e)

Group	Men Q ₄	Women Q ₄
Fresh veg.	20	30
Fruit	31	121
Rice	367	220
Wheat flour	79	180
Meat	70	63
Fish	23	46

There is not a very large difference in the patterns of consumption but accordingly men eat more meat and wheat flour than women who consume more rice and fresh vegetables.

Ans (f) When finding the standard deviation of all the food groups given a conclusion is drawn where we see that the standard deviations of whole grain and root vegetable for both men and women is very less. The standard deviations for whole grain in both men and women are 3.61 & 3.92 respectively. Whereas for root vegetable the standard deviations for men and women are 3.61 & 3.92 respectively. Therefore whole grain and root vegetable is the best result.

Question 2) In the UK there has been a national census every 10 years since 1801 (with the exception)

Ans 2a) Censuses are official counts or surveys especially of a population.

The purpose of a census is to enumerate and collect data on every being in the population.

b) Census is a snapshot whereas various administrative records span continuous time and would have to be analysed with some difficulty, to get a spot figure of a particular date.

It differs from a sample survey in that by definition a sample survey does not attempt to reach the whole population.

A census will differ from records held by the government departments in that it aims to be complete whereas government department records will not be.

Censuses also address particular questions which government records are unlikely to contain and census is a legal requirement.

c) A participation rate of 94% is considered quite high and to that extent might be regarded as giving a very good information when compared with the other data given.

However it is concerning the missing of the 6% from the 94% and could

Question 2
con h ...

c) come under the category of homeless, ill or mentally not fit which could raise an issue of inaccuracy.

d) 'Jedi knight' was a manmade religion which did not make real sense clearly indicating the lack of seriousness that people held towards census.

It also indicates the hatred or distrust of people towards the government and the data collecting agencies of the government. The rise and decline of religions could also be considered a real phenomena.

e) Conducting online census in 2021 does sound like a good idea but present problems for excluded groups also those without internet access or those who are old or are too poor to do so. To reach these group it be necessary to send batches of people to collect information from them. Persuasion could also be a problem to persuade people to complete the ~~of~~ online ~~survey~~ by going and filling them than to ask them to directly fill a printed form. Cyber hacking and breaching of information are other concerning problems.

f) Other potential problems in incorporating additional data may include lack of or incomplete data held by the government and record matching and combining of data could be a huge problem to deal with.

Question 3: a. Find A, M, G, M, H, M, Median, Mode, Quartiles, Deciles, percentile, Range, M, D, Q, D Variable, variance, Standard Deviation, Coefficient of variation, Skewness for the following data-

Rainfall (inches)	Number of Years
20-24	1
25-29	3
30-34	5
35-39	8
40-44	5
45-49	2
50-54	0
55-59	1

Solution: i) It is group data for arithmetic mean

a. we will find A.M

∴ Arithmetic Mean: formulae: $\bar{x} = \frac{\sum fx}{\sum f}$
(A.M)

we have $\sum f = 25$, now we have to find $\sum fx$ (that is sum of $f \times x$)

Here f is given 1, 3, 5, 8, 5, 2, 0, 1

we shall now find 'x' from classes:-

	Classes	f	x	fx
table 3.1a for A.M	20-24	1	$\frac{20+24}{2} = 22$	22
	25-29	3	$\frac{25+29}{2} = 27$	81
	30-34	5	32	160
	35-39	8	37	296
	40-44	5	42	210
	45-49	2	47	94

Fig 3.1a)	50-54	0	52	0
Continue:	55-59	1	57	57
			total Σf = 25	$\Sigma fx = 920$

solved 'x' by adding classes and \div it by 2
to find $fx = \text{frequency } f \times x$ or fx

$$\text{now } \bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{920}{25}$$

$$\text{A.M or } \bar{x} = 36.8$$

ii) G.M for Group data: Geometric mean (G.M)

$$\text{formula: } G.M = \text{Antilog} \left[\frac{\Sigma f \log x}{\Sigma f} \right]$$

we have x & f values now
we have to find $\log(x)$ & $f \log x$
then antilog of all this

	x	f	$\log x$	$f \log x$
	22	1	1.34	1.34
	27	3	1.43	4.29
	32	5	1.51	7.55
Fig 3.2	37	8	1.57	12.56
a	42	5	1.62	8.10
	47	2	1.67	3.34
	52	0	1.72	0
	57	1	1.76	1.76
		$\Sigma f = 25$		$\Sigma f \log 38.94$

$$G.M = \text{Antilog} \left[\frac{\Sigma f \log x}{\Sigma f} \right]$$

Question 3 a)
cont...

$$\text{Antilog} \left[\frac{38.94}{25} \right]$$

$$\text{Antilog} = (1.55)$$

$$\text{G.M} = 35.48$$

iii) Harmonic Mean: for group data

$$\text{for H.M: } \frac{\sum f}{\sum f/x}$$

It is used to calculate average
we have x , f now we have to find $\sum f/x$

Fig 3.3a

x	f	f/x
22	1	0.04
27	3	0.11
32	5	0.15
37	8	0.21
42	5	0.11
47	2	0.04
52	0	0
57	1	0.01
	$\sum f = 25$	0.708

$$\begin{aligned} \text{H.M} &= \frac{\sum f}{\sum f/x} \\ &= \frac{25}{0.708} \end{aligned}$$

$$\text{H.M} = 35.31$$

Question 3a) iv) Median for group data.

comb...

$$\text{Formulae: } l_1 + \frac{h}{f} \left(\frac{n}{2} - c.f \right)$$

where:

l : lower class limit

h : height

f : frequency

n : total number of observation

$c.f$: cumulative frequency

Fig 3.4
a

classes	f	$c.f$
20 - 24	1	1
25 - 29	3	1+3=4
30 - 34	5	4+5=9
35 - 39	8	9+8=17
40 - 44	5	17+5=22
45 - 49	2	22+2=24
50 - 54	0	24+0=24
55 - 59	1	24+1=25

$$\text{now } \frac{n}{2} = \frac{\sum f}{2} = \frac{25}{2} = 12.5$$

$$\text{so now } l = 35$$

$$\frac{n}{2} = 12.5$$

$$h = 5$$

$$f = 8$$

$$c.f = 9$$

$$\text{formula} = l + \frac{h}{f} (n/2 - c.f)$$

$$= 35 + \frac{5}{8} (12.5 - 9)$$

$$\text{Median} = 36.8 = 37$$

Question 3a) v) Mode : for grouped data

(midpoint) (mode : frequency value occur).

$$\text{mode} = l + \frac{(f_m - f_1)}{(f_m - f_1) + (f_m - f_0)} \times h$$

$$M = l + \left(\frac{f_1 + f_0}{2f_1 - f_0 - f_2} \right) h$$

	classes	f	
Fig 3.5 a	20-24	1	
	25-29	3	
	30-34	5	
	35-39	8	→ highest frequency (35-39)
	40-44	5	
	45-49	2	
	50-54	0	
	55-59	1	

where f_1 = frequency of mode class

f_0 = frequency of class

f_2 = frequency of succeeding class

l : lower limit h : class interval

$$\text{so mode} = l + \left(\frac{f_1 + f_0}{2f_1 - f_0 - f_2} \right) h$$

$$= 35 + \left(\frac{8 - 5}{2(8) - 5 - 5} \right) \times 5$$

$$= 35 + 2.5$$

$$\text{mode} = 37.5$$

Question 3a) vi) Quartile : of grouped data
conh...

We need to find Q_1, Q_2, Q_3

As $Q_2 = \text{median}$ and we already found median.

moving on we need to find Q_1 & Q_3

$$Q_1 = L + \left(\frac{n/4 - cf}{f} \right) c$$

$$Q_3 = L + \left(\frac{3n/4 - cf}{f} \right) c$$

	classes	f	cf
	20-24	1	1
	25-29	3	4
Fig	30-34	5	9
	35-39	8	17
3.6	40-44	5	22
a	45-49	2	24
	50-54	0	24
	55-59	1	25
		<u>25</u>	

$$\text{now } n/4 = 25/4 = 6.25$$

so we find the cf value closest to 6.25

so it is class 4 (25-29) our Q_1

lies in 25-29

$$\text{formulae} = Q_1 = L + \left(\frac{n/4 - cf}{f} \right) c$$

where:

$$L = 25, n = 25, cf = 4, f = 3, c = 5$$

$$Q_1 = 25 + \left(\frac{25/4 - 4}{3} \right) 5$$

$$= 25 + \left(\frac{2.25}{3} \right) 5$$

(Question 3a)

conh...

$$Q_1 = 25 + (0.75)5$$

$$= 25 + 3.75$$

$$Q_1 = 28.75$$

now find Q_3

$$Q_3 = L_1 + \left(\frac{3n/4 - cf}{f} \right) c$$

find $3(n/4)$

$$= 3(25/4) = 18.75$$

value of cf closest to 18.75 is 17
class (35-39)here $l = 35$, $n = 25$, $cf = 17$, $f = 8$, $c = 5$

$$Q_3 = 35 + \left(\frac{3(25/4) - 17}{8} \right) 5$$

$$= 35 + (1.75/8)5$$

$$= 35 + (0.21)5$$

$$Q_3 = 36.05$$

viii) Deciles : for group data

In order to find deciles

we need D_1, D_2, \dots, D_{10} to find $D_1 = l + \left(\frac{n/10 - cf}{f} \right) h$ where $l = 25$, $f = 3$, $h = 5$, $cf = 1$

$$D_1 = 25 + \left(\frac{25/10 - 1}{3} \right) 5$$

$$D_1 = 27.5$$

To find $D_2 =$

$$D_2 = l + \left(\frac{2n/10 - cf}{f} \right) h$$

Question 3a) where $l = 30, f = 5, cf = 4, h = 5$
 con h...

$$D_2 = l + \left(\frac{2n/10 - cf}{f} \right) h$$

$$= 30 + \left(\frac{2(25/10) - 4}{5} \right) 5$$

$$D_2 = 31$$

To find D_3

$$D_3 = l + \left(\frac{3n/10 - cf}{f} \right) h$$

$$= 30 + \left(\frac{3 \times 25/10 - 4}{5} \right) 5$$

$$D_3 = 33.5$$

....

To find D_8

$$D_8 = l + \left(\frac{8n/10 - cf}{f} \right) h$$

$$D_8 = 40 + \left(\frac{8 \times 25/10 - 5}{5} \right) 5$$

$$D_8 = 43$$

To find $D_9 = 9n/10 = 9 \times 25/10 = 22.5$

$$D_9 = l + \left(\frac{9n/10 - cf}{f} \right) h$$

$$= 45 + \left(\frac{9 \times 25/10 - 22.5}{5} \right) 5$$

$$D_9 = 46.25$$

To find $D_{10} = 10n/10 = 10 \times 25/10 = 25$

$$D_{10} = l + \left(\frac{10n/10 - cf}{f} \right) h$$

Question 3a)
Continue

$$D_{10} = 55 + \left(\frac{10 \times 25 / 10 - 24}{1} \right) 5$$

$$D_{10} = 60$$

viii) Percentile : for group data

$$P_i = l + \left(\frac{n/100 - cf}{f} \right) c$$

$$P_1 = 25/100 = 0.25$$

$$P_1 = 27.5$$

To find P_{10} :

$$P_{10} = 10 \times n / 100 = 10 \times 25 / 100 = 2.5$$

$$\text{so } P_{10} = l + \left(\frac{n/100 - cf}{f} \right) c$$

$$= 25 + \left(\frac{10 \times 25 / 100 - 1}{3} \right) 5$$

$$P_{10} = 27.5$$

To find P_{20} :

$$P_{20} = 20 \times n / 100 = 20 \times 25 / 100 = 5$$

$$\text{so } P_{20} = l + \left(\frac{20n/100 - cf}{f} \right) c$$

$$= 30 + \left(\frac{20 \times 25 / 100 - 4}{5} \right) 5$$

$$P_{20} = 31$$

To find P_{30} :

Question 3a)

Conti...

$$P_{30} = 30n/100 = 30 \times 25/100 = 7.5$$

$$P_{30} = l + \left(\frac{30n/100 - cf}{f} \right) c$$

$$= 30 + \left(\frac{30 \times 25/100 - 4}{5} \right) 5$$

$$P_{30} = 33.5$$

To find P_{40}

$$P_{40} = 40n/100 = \frac{40 \times 25}{100} = 10$$

$$P_{40} = l + \left(\frac{40n/100 - cf}{f} \right) c$$

$$= 35 + \left(\frac{40 \times 25/100 - 9}{8} \right) 5$$

$$P_{40} = 35.62$$

To find P_{50}

$$P_{50} = 50n/100 = \frac{50 \times 25}{100} = 12.5$$

$$P_{50} = l + \left(\frac{50n/100 - cf}{f} \right) c$$

$$= 35 + \left(\frac{50 \times 25/100 - 9}{8} \right) 5$$

$$P_{50} = 37.18$$

To find P_{60}

$$P_{60} = 60n/100 = \frac{60 \times 25}{100} = 15$$

$$P_{60} = l + \left(\frac{60n/100 - cf}{f} \right) c$$

$$= 35 + \left(\frac{60 \times 25/100 - 9}{8} \right) 5$$

$$P_{60} = 38.75$$

Question 3a) P_{70} : To find $P_{70} = \frac{70n}{100} = \frac{70 \times 25}{100} = 17.5$
 comb...

$$P_{70} = l + \left(\frac{70n/100 - cf}{f} \right) c$$

$$= 40 + \left(\frac{70 \times 25 / 100 - 17}{5} \right) 5$$

$$P_{70} = 40.5$$

P_{80} : To find $P_{80} = \frac{80n}{100} = \frac{80 \times 25}{100} = 20$

$$P_{80} = l + \left(\frac{80n/100 - cf}{f} \right) c$$

$$= 40 + \left(\frac{80 \times 25 / 100 - 17}{8} \right) \times 5$$

$$P_{80} = 41.87$$

....

P_{100} : To find $P_{100} = \frac{100n}{100} = \frac{100 \times 25}{100} = 25$

$$P_{100} = l + \left(\frac{100n/100 - cf}{f} \right) c$$

$$= 55 + \left(\frac{100 \times 25 / 100 - 24}{1} \right) 5$$

$$P_{100} = 60$$

ix) Range : for grouped data

Range - largest value - smallest value

$$\text{Range} = (L) - (S)$$

To find Range we find L & S from classes

Question 3a) con h:...

Fig 3.6 a	classes	
	20-24	→ lowest and lowest / smallest is 20
	25-29	
	30-34	
	35-39	
	40-44	
	45-49	
	50-54	
	55-59	→ largest

so the largest value is 59
so
Range = L - S
= 59 - 20
= 39

Range = 39

x.) Mean deviation (M.D)

$$M.D = \frac{\sum f(x - \bar{x})}{\sum f}$$

we first need to find $(x - \bar{x})$ then the given data the $f(x - \bar{x})$ using the data we extracted:

Fig 3.7 a	classes	x	f	$x - \bar{x}$	$f(x - \bar{x})$
	20-24	22	1	-14.8	-14.8
	25-29	27	3	-9.8	-29.4
	30-34	32	5	-4.8	-24
	35-39	37	8	0.2	1.6
	40-44	42	5	5.2	26
	45-49	47	2	10.2	20.4
	50-54	52	0	15.2	0
	55-59	57	1	20.2	20.2
			=	$\sum(x - \bar{x})$	$\sum f(x - \bar{x})$
			27	= 21.6	= 0

Question 3a) we have found $\bar{x} = 36.8$ on.
 cont... so found $\sum (x - \bar{x}) = 0$

$$\begin{aligned} \text{then} \\ M.D = \frac{\sum f(x - \bar{x})}{\sum f} \\ = \frac{0}{25} = 0 \end{aligned}$$

$$M.D = 0$$

xii) Quartile Deviation Q.D of Group data

$$Q.D = \frac{Q_3 - Q_1}{2}$$

Since we have already found Q_1, Q_2 & Q_3 now using the earlier found data we know $Q_1 = 28.75$

$$Q_3 = 36.05$$

$$\begin{aligned} \text{So } &= \frac{Q_3 - Q_1}{2} \\ &= \frac{36.05 - 28.75}{2} \\ &= 7.3/2 \end{aligned}$$

$$Q.D = 3.65$$

xii) Variance: of grouped data

$$\text{Variance} = \frac{\sum f(x - \bar{x})^2}{\sum f - 1}$$

we have to find $\sum f(x - \bar{x})^2$ & $\sum f$

Question 3a)

cont...

Fig
3.8a

classes	f	$x - \bar{x}$	$(x - \bar{x})^2$	$f(x - \bar{x})^2$
20-24	1	-14.8	219.04	219.04
25-29	3	-9.8	96.04	288.12
30-34	5	-4.8	23.04	115.2
35-39	8	0.2	0.04	0.32
40-44	5	5.2	27.04	135.2
45-49	2	10.2	104.04	208.08
50-54	0	15.2	231.04	0
55-59	1	20.2	408.04	408.04
	$\Sigma f = 25$	$\Sigma (x - \bar{x}) = 21.6$	$\Sigma (x - \bar{x})^2 = 1108.04$	$\Sigma f(x - \bar{x})^2 = 1374$

$$\text{Variance} = \frac{\Sigma f(x - \bar{x})^2}{\Sigma f - 1}$$

$$\text{variance} = \frac{1374}{25 - 1} = 57.25$$

$$\text{variance} = 57.25$$

xiii) Standard Deviation : S.D

formula:

SD or Standard deviation = $\sqrt{\text{variance}}$

$$SD = \sqrt{\frac{\Sigma f(x - \bar{x})^2}{\Sigma f - 1}}$$

$$SD = \sqrt{57.25}$$

$$SD = 7.56$$

Question 3a) xiv) Co efficient of variation CV for group data

$$\text{formulal} \cdot \frac{S.D.}{\bar{x} \text{ mean}} \times 100$$

where variance is 57.25

$$SD : 7.56$$

$$\bar{x} \text{ mean} : 36.8$$

$$= 7.56 / 36.8 \times 100$$

$$C.V = 20.54$$

$$\text{coefficient value} : 20.54$$

xv) Skewness: grouped data

we know mean mode value

$$i) sk = \text{mean} - \text{mode}$$

$$36.8 - 37.5$$

$$= -0.7$$

It is -ve skewed

ii) Karl Pearson coefficient of skewness

$$\text{skp or skewness} : \frac{\text{mean} - \text{mode}}{S.D.}$$

$$: \frac{36.8 - 37.5}{7.56}$$

$$\text{skp} : -0.09$$

iii) Bowley's co-efficient of skewness

$$\text{skp} : \frac{Q_3 + Q_1 - 2Q_2}{Q_3 - Q_1} = \frac{42.5 + 32.5}{36.05 - 28.75}$$

$$\text{skp} = -0.30$$

Question 3b)
Conti...

i) Arithmetic Mean (A.M) ungrouped

$$\text{Arithmetic Mean: } \frac{\sum x}{n}$$

or \bar{x}

Ungrouped:

21, 25, 29, 29, 30, 31, 32, 33, 32
34, 35, 35, 35, 36, 37, 38, 39, 41
40, 43, 48, 44, 47, 48, 59

largest = 59
smallest = 21

$$\text{A.M or } \bar{x} : \frac{21, 25, 29, \dots, 48, 59}{25}$$

$$\text{A.M: } \frac{918}{25} = 36.7$$

$$\bar{x} \text{ or A.M} = 36.7$$

ii) Geometric mean (GM) ungrouped

$$\text{Geometric mean: } \text{Antilog} \frac{\sum \log x}{n}$$

GM

$$\text{where GM: } \text{Antilog: } \frac{38.8}{25}$$

$$\text{Antilog: } 1.5312$$

$$\text{Antilog: } 1.5312$$

so

$$\text{GM} = 35.7$$

this was calculated with the following table that is drawn on the next page

Question 3b)

conh...

x	$\log x$	$1/x$
21	1.32	0.047
25	1.39	0.04
29	1.46	0.034
30	1.47	0.033
31	1.49	0.032
32	1.51	0.031
33	1.52	0.030
34	1.53	0.029
35	1.54	0.028
36	1.55	0.027
37	1.57	0.027
38	1.58	0.026
39	1.59	0.025
41	1.61	0.024
42	1.62	0.024
43	1.63	0.023
44	1.64	0.022
47	1.67	0.021
48	1.68	0.020
59	1.77	0.016

Fig 3.1b

iii) Harmonic Mean (HM) ungrouped

$$HM \text{ of } x = \frac{\sum n}{\sum (1/x)}$$

$$= 20 / 0.559$$

$$HM = 35.7$$

Question 3b) iv) Median for ungrouped data
Conh...

$$\begin{aligned} \text{where median} &= \left(\frac{n+1}{2} \right) \\ &= \frac{20+1}{2} \\ &= \frac{21}{2} = 10.5 \end{aligned}$$

where we equal the $n=20$ which is the number of observation

$$\text{Median} = 10.5$$

v) Mode for ungrouped data

It is the maximum number of observation so the maximum time an observation occurred is 35

$$\text{Mode} = 35$$

vi) Quartiles for ungrouped data

We need to find Q_1, Q_2, Q_3

To find Q_1 the following formulae is to be used

$$Q_1 = \left(\frac{n+1}{4} \right)$$

note
: data

used
from fig 3.1b

where $n=20$

$$\text{so } Q_1 = \left(\frac{20+1}{4} \right) = \frac{21}{4} = 5.25$$

moving 5 step forward gives us 31

Question 3b)
len h...

so $31 + 0.25$ (left from 5.25)

$$= 31.25$$

$$Q_1 = 31.25$$

To find Q_2 :

$$Q_2 = 2\left(\frac{n+1}{4}\right)$$

$$= 2\left(\frac{20+1}{4}\right) = 2\left(\frac{21}{4}\right) = 2(5.25)$$

$$= 10.5$$

10 step forward gives us 36

so $36 + 0.5$ (left from 10.5)

$$= 36.5$$

$$Q_2 = 36.5$$

To find Q_3

$$Q_3 = 3\left(\frac{n+1}{4}\right) = 3\left(\frac{20+1}{4}\right) = 3\left(\frac{21}{4}\right)$$

$$= 3(5.25) = 15.75$$

moving 15 step forward gives us

$$= 42 + 0.75$$

$$Q_3 = 42$$

To find Q_4

$$Q_4 = 4\left(\frac{n+1}{4}\right) = 4\left(\frac{20+1}{4}\right) = 4\left(\frac{21}{4}\right)$$

$$= 4(5.25) = 21$$

cannot move 21 step only 20 observations are present

$$Q_4 = \text{error}$$

Question 3b) vii) Decile: for ungrouped data
 con h...

In order to find decile
 we need to find D_1, D_2, \dots, D_{10}
 To find D_1 : $\frac{n+1}{10}$

$$= \frac{20+1}{10} = \frac{21}{10} = 2.1$$

moving two step
 $2.1 + 1$

$$D_1 = 2.1$$

To find D_2 : $2 \left(\frac{n+1}{10} \right)$

$$= 2 \left(\frac{20+1}{10} \right) = 2 \left(\frac{21}{10} \right) = 2(2.1)$$

$$= 4.2$$

moving four steps

$$= 30 \text{ so } 30 + 2$$

$$D_2 = 30.2$$

To find D_3

$$D_3 = 3 \left(\frac{n+1}{10} \right)$$

$$3 \left(\frac{20+1}{10} \right) = 3(2.1) = 6.3$$

moving six step giving us 32

$$\text{so } 32 + 3$$

$$D_3 = 32.3$$

...

To find D_8

$$D_8 = 8 \left(\frac{n+1}{10} \right) = 8 \left(\frac{21}{10} \right)$$

$$= 8(2.1) = 16.8$$

Question 3b)
cont...

D_8 : move 16 steps we get 43

$$43 + 0.8$$

$$D_8 = 43$$

To find D_9

$$D_9: 9\left(\frac{n+1}{10}\right) = 9\left(\frac{21}{10}\right)$$

$$= 18.9$$

moving 18 step we get 47

$$47 + 0.9$$

$$D_9 = 47.9$$

To find D_{10} :

$$D_{10}: 10\left(\frac{n+1}{10}\right) = 10\left(\frac{21}{10}\right)$$

$$= 21 \text{ (can't move 21 step)}$$

$$D_{10} = \text{error}$$

viii) Percentile for ungrouped data

To find P_1 :

$$P_1 = \left(\frac{n+1}{100}\right) = \frac{21}{100} = 0.21$$

cannot move 0.21 steps.

$$P_1 = \text{error}$$

$$\text{To find } P_{10}: 10\left(\frac{n+1}{100}\right) = 10\left(\frac{21}{100}\right) = 2.1$$

move 2 steps.

$$25 + 0.1$$

$$P_{10} = 25$$

$$\text{To find } P_{20} = 20\left(\frac{n+1}{100}\right) = 20\left(\frac{21}{100}\right) = 4.2$$

moving 4 steps

$$= 30 + 0.2 = 30.2$$

$$P_{20} = 30.2$$

Question 3b)
cont...

$$P_{30} = 30 \left(\frac{n+1}{100} \right) = 30 \left(\frac{21}{100} \right) = 5.3$$

moving 5 steps we get 32

$$= 32 + 0.3$$

$$P_{30} = 32.3$$

$$\text{To find } P_{40} = 40 \left(\frac{n+1}{100} \right) = 40 \left(\frac{21}{100} \right)$$

moving 8 step we get 34

$$= 34 + 0.04$$

$$P_{40} = 34.04$$

To find $P_{50} =$

$$P_{50} = 50 \left(\frac{n+1}{100} \right) = 50 \left(\frac{21}{100} \right)$$

moving 10 step we get 36

$$36 + 0.5$$

$$P_{50} = 36.5$$

...

To find P_{80}

$$P_{80} = 80 \left(\frac{n+1}{100} \right) = 80 \left(\frac{21}{100} \right) = 16.8$$

moving 16 steps we get 43

$$P_{80} = 43.8$$

$$\text{To find } P_{90} = 90 \left(\frac{n+1}{100} \right) = 90 \left(\frac{21}{100} \right)$$

moving 18 step we get 47

$$47 + 0.95$$

$$P_{90} = 47.95$$

$$\text{To find } P_{100} = 100 \left(\frac{n+1}{100} \right) = 100 \left(\frac{21}{100} \right) = 21$$

$$P_{100} = 21$$

Question 3b)
Conti...

ix) Range for ungrouped data

$$\text{Range} = \text{largest value} - \text{smallest value} \\ = (L) - (s)$$

To find Range we find L & s from the classes.

so the largest is 59

smallest is 21

$$\text{Range} = L - s \\ = 59 - 21$$

$$\text{Range} = 38$$

x.) Quartile Deviation (QD) for ungrouped

$$Q.D = \frac{Q_3 - Q_1}{2}$$

since we have already found

Q_1, Q_2 & Q_3

$$= \frac{Q_3 - Q_1}{2}$$

$$= \frac{42 - 31.25}{2}$$

$$Q.D = 5.37$$

xi) Mean Deviation (MD) for ungrouped

we to find out mean deviation
know the values of x

but we need to find out the

values of $(x - \bar{x})$

and $(x - \bar{x})^2$ to do so

the below mention table

is drawn:

Question 3b)

conh...

x	$(x - \bar{x})$	$(x - \bar{x})^2$
21	-16.2	262
25	-12.2	148
29	-8.2	67.2
30	-7.2	51.8
31	-6.2	38.4
32	-5.2	27.0
33	-4.2	17.6
34	-3.2	10.2
35	-2.2	4.84
36	-1.2	1.44
37	-0.2	0.04
38	+0.3	0.64
39	1.8	3.24
41	3.8	14.4
42	4.8	23.0
43	5.8	23.6
44	6.8	46.2
47	9.8	96.0
48	10.8	116.6
59	21.8	475.2

formulae:

$$M.D: \Sigma = \frac{\Sigma (x - \bar{x})}{n} \text{ where}$$

$$\Sigma = \Sigma (x - \bar{x}) = 0$$

$$n = 20$$

$$= \frac{0}{20} = 0$$

$$M.D = 0$$

Question 3b) xii) Variance for ungrouped data:

Conh...

$$\text{Variance } \sigma^2 = \frac{\sum (x - \bar{x})^2}{n-1}$$

so

$$s^2 = \frac{1414.4}{20-1}$$

$$s^2 = 74.4$$

$$\text{so Variance} = 74.4$$

xiii) Standard Deviation for ungroup data

$$S.D : \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

$$S.D : \sqrt{\text{variance}}$$

$$S.D : \sqrt{74.44}$$

$$S.D : 8.6$$

xvi) Coefficient of variance for ungrouped

$$\begin{aligned} \text{coefficient of variance} &= \frac{S.D}{\bar{x}} \times 100 \\ &= \frac{8.6}{36.7} \times 100 \\ &= 23.4 \end{aligned}$$

$$\text{coefficient of variance} : 23.4$$

Question 3b:
Conti...

xv) skewness: ungrouped data
we know mean and mode value

$$i) \text{sk} = \text{mean} - \text{mode} \\ = 36.7 - 35$$

$$\text{skp} = 0.7$$

It is +ve skewness

ii) Karl's Pearson's coefficient of skewness

$$\text{skp} = \frac{\text{mean} - \text{mode}}{\text{S.D}}$$

$$= \frac{0.7}{8.6}$$

$$\text{skp} = 0.081$$

iii) Bowley's coefficient of skewness

$$\text{skp} = \frac{Q_3 - Q_1 - 2Q_2}{Q_3 - Q_1}$$

$$\text{skp} = \frac{42 - 31.25 - 2 \times 36.5}{42 - 31.25}$$

$$\text{skp} = 5.79$$