9. Explain mean, median and mode as measures of central tendency. Give a comparative study of their relative advantages and disadvantages as measures of central tendency. [C.U. B.Com.(H) 1991]

Problems (A)

1. (a) The weekly wages of 5 labourers are (in ₹) 40, 60, 36, 45, 25. Calculate their AM.

   (b) Find the arithmetic mean of 14, 16, 19, 25, 21.

   (c) If the mean of 7, $x-3$, 10, $x+3$ and $x-5$ is 15, find x. [C.U. B.Com. 2002]

2. (a) Find the Geometric Mean and the Harmonic Mean of the numbers 1, 9, 81.

(b) Find the Geometric Mean of:
(i) 1, 3, 9.
(ii) 2, 9, 12.
(iii) 3, 8, 9.
(iv) 6, 24, 12.
(v) 2, 8, 9 with weights 1, 1, 2.

(c) If the GM of a, 4, 8 be 6, find a.

3. Calculate the Arithmetic Mean, Geometric Mean and Harmonic Mean of four numbers: [C.U. B.Com. 2006]
(a) 3, 6, 24 and 48.
(b) 4, 6, 12 and 72.
(c) 24, 72, 108 and 144. [C.U. B.Com. 1997]

4. Find the Harmonic Mean of the following numbers:
(a) $1, \frac{1}{2}, \frac{1}{3}, \ldots, \frac{1}{n}$.
(b) $1, \frac{1}{3}, \frac{1}{5}, \ldots, \frac{1}{2n-1}$.

5. (a) Find the Median of the following numbers:
(i) 7, 2, 5, 9, 6.
(ii) 8, 3, 11, 7, 12, 6, 9.
(iii) 33, 86, 68, 32, 80, 48, 70.
(iv) 25, 15, 23, 40, 27, 25, 23, 25 and 20.

(b) Find the Mode of the numbers: [V.U. B.Com.(H) 2008]
(i) 5, 3, 27, 5, 9, 3, 8, 5.
(ii) 4, 3, 2, 5, 3, 4, 5, 3, 7, 3, 2, 6.
(iii) 3, 2, 5, 4, 4, 2, 4, 3, 3, 4, 4, 5, 4, 2, 4, 4, 2, 4, 5, 4, 4. [C.U. B.Com. 2000]

(c) Find the Mode and Median of the following numbers:
(i) 25, 1275, 748, 162, 967, 162;
(ii) 108, 94, 107, 84, 108, 79, 115, 119, 98, 102, 122. [V.U. B.Com.(H) 2007]

6. Find the Median of the following numbers:
(a) 3, 9, 7, 4, 8, 6. [C.U. B.Com. 1995]
(b) 94, 33, 86, 68, 32, 80, 48, 70. [C.U. B.Com. 2007]
(c) 79, 82, 36, 38, 51, 72, 68, 70, 64, 63.

7. (a) Find the Mean and Mode of the numbers: 4, 3, 2, 5, 3, 4, 5, 1, 7, 3, 2, 1.
(b) Find the Mean and the Mode of the set of numbers: 7, 4, 10, 15, 7, 3, 5, 2, 9, 12.
(c) Find the Median and Mode of the numbers: 3, 2, 5, 4, 4, 2, 4, 3, 3, 4, 4, 5, 4, 2, 4, 4, 2, 4, 5, 4, 4. [C.U. B.Com. 2000]
(d) Find the Median and Mode of the numbers: 4, 10, 7, 15, 7, 3, 5, 3, 7. [C.U. B.Com. 1990]
(e) Find the Mean, Median and Mode of the following numbers: 7, 4, 3, 5, 6, 3, 3, 2, 4, 3, 4, 3, 3, 4, 4, 3, 2, 2, 4, 3, 5, 4, 3, 4, 3, 4, 3, 1, 2, 3.

8. Find the AM of the following distribution:

Weights (in pounds)	100	110	120	130	140
No. of men	15	20	25	30	10

9. Calculate the Arithmetic Mean and Mode from the following data:

Value	1	2	3	4	5	6	7	8	9	Total
Frequency	7	11	16	17	26	31	11	1	1	121

10. Find the mean of weekly wages from the following frequency distribution:

Wages (in ₹)	30–40	40–50	50–60	60–70	70–80	80–90
No. of workers	10	20	40	16	8	6

11. (a) Find the arithmetic mean of the weekly income from the following frequency distribution:

Weekly income (in ₹)	20–25	25–30	30–35	35–40	40–45	45–50
No. of workers	200	700	900	800	600	400

(b) Calculate the mean from the following table:

Monthly wages (in ₹)	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90
No. of workers	15	44	104	225	310	355	108	72	17

[B.U. B.Com. 1998]

12. Find the mode of the following distributions:

(a)

Marks	5	10	15	20	25	30	35
No. of students	2	6	10	15	12	8	4

(b)

Marks	0–10	10–20	20–30	30–40	40–50
No. of students	4	12	18	14	8

13. (a) Find the median from the following frequency distribution:

Marks	0–10	10–20	20–30	30–40	40–50
No. of students	10	20	35	25	10

(b) Find the median of the following distribution:

Weight in lb	160–162	163–165	166–168	169–171	172–174
No. of men	15	54	126	81	24

[C.U. B.Com. 2007]

14. (a) A sample of size 50 has mean 54.4 and another sample of size 100 has mean 50.3. If the two samples are pooled together, find the mean of the combined sample. [B.U. B.Com. 1990]

(b) The mean annual salary of all employees in a company is ₹25,000. The mean salaries of male and female employees are ₹27,000 and ₹ 17,000 respectively. Find the percentage of males and females employed in the company. [CA Foun. Nov. 1995]

15. (a) If the Mean and Mode of a certain set of numbers be 60.4 and 50.2 respectively, find approximately the value of the Median.

(b) For a moderately asymmetric distribution, Median = 27, Mean =26. Find the mode.

(Use empirical relation between Mean, Median and Mode.) [C.U.B.Com. 2000]

16. (a) The table below gives the marks obtained in Statistics by 60 students:

Class-interval	0–10	10–20	20–30	30–40	40–50	50–60	60–70
Frequency	5	8	11	15	13	6	2

With the help of the cumulative frequency diagram or otherwise, determine the median mark of a student. [C.U.B.Com. 2004]

(b) Obtain the quartiles of the following distribution:

Ages (in years)	50	52	54	58	60	62	64	66	68	70
Frequency	4	12	18	23	30	26	22	16	5	4

[C.U.B.Com. 2002]

17. Below is given the frequency distribution of weights of a group of 60 students in a class in a school:

Weight (in kg)	30–34	35–39	40–44	45–49	50–54	55–59	60–64
No. of students	3	5	12	18	14	6	2

Draw the cumulative frequency diagrams and hence determine the median weight. Find also the quartiles of the distribution.

18. The table below gives the frequency distribution of weights of 85 apples:

Weight in gm	110–119	120–129	130–139	140–149	150–159	160–169	170–179	180–189
Frequency	5	8	12	18	22	9	7	4

Determine the median weight of an apple.

19. (a) The frequency distribution of wages of 100 workers is as follows:

Wages (₹)	250–259	260–269	270–279	280–289	290–299	300–309
No. of workers	8	16	30	34	10	2

Calculate the value of the median from the above data.

(b) Find the mode of the following distribution:

Weight (in gm)	410–419	420–429	430–439	440–449	450–459	460–469	470–479
Frequency	14	20	39	54	45	18	10

20. (a) Marks obtained by 22 students are given below:

Marks obtained	0–10	10–20	20–30	30–40
No. of students	2	4	9	7

Find the mode of the above distribution.

(b) Find the mode of the following data:

Monthly wages (₹)	125–175	175–225	225–275	275–325	325–375	375–425	425–475
No. of workers	8	10	25	35	12	10	4

(c) Find the mode of the following frequency distribution:

Age (in years)	16-20	21-25	26-30	31-35	36-40	41-45	46-50
Population (in thousand)	4	6	11	5	7	8	3

[C.U. B.Com. 2007]

21. (a) The AM of the following frequency distribution is 36.3. Find the missing frequency:

Marks	10–20	20–30	30–40	40–50	50–60
No. of students	12	18	?	25	15

(b) The arithmetic mean calculated from the following frequency distribution is known to be 67.45 inches. Find the value of f_3.

Height (inches)	60–62	63–65	66–68	69–71	72–74
Frequency	15	54	f_3	81	24

[C.U. B.Com.(H) 2008]

22. The median of the following distribution is 33. Find the missing frequency.

Marks	0–10	10–20	20–30	30–40	40–50	50–60
No. of students	8	12	21	?	20	9

23. The mode of the following frequency distribution is ₹66. Find the missing frequency.

Daily wages (₹)	30–40	40–50	50–60	60–70	70–80	80–90
No. of workers	8	16	22	28	?	12

[C.U. B.Com. 2005]

24. (a) Construct the grouped frequency distribution from the following data and hence find its Arithmetic Mean:

Marks	No. of students
Less than 10	175
Less than 20	360
Less than 30	680
Less than 40	790
Less than 50	900
Less than 60	1000

[C.U. B.Com. 1995; V.U. B.Com. 1998]

(b) Construct a grouped frequency distribution from the following data and hence find the median and mode:

Marks obtained	No. of students
Below 10	175
Below 20	360
Below 30	680
Below 40	790
Below 50	900
Below 60	1000

[C.U. B.Com. 2008]

25. Construct the grouped frequency distribution from the following data and hence find its AM and Median:

Value	Below 10	Below 20	Below 30	Below 40	Below 50	Below 60	Below 70	Below 80
Frequency	4	16	40	76	96	112	120	125

[N.B.U. B.Com. 1994]

26. The AM and GM of two numbers are 25 and 15 respectively, find the two numbers.

[C.U. B.Com. 2008]

[Hints: Let the two numbers be x and y. Then $\frac{x+y}{2} = 25$ and $\sqrt{xy} = 15$ or, $x+y=50$ and $xy=225$.

$\therefore (x-y)^2 = (x+y)^2 - 4xy = (50)^2 - 4 \times 225 = 2500 - 900 = 1600$; $\therefore x - y = \pm 40$.

Solving $x+y=50$ and $x-y=40$, $x=45$, $y=5$. If $x+y=50$, $x-y=-40$, then $x=5$, $y=45$. Hence, *the two numbers are* 5 and 45.]

27. An incomplete frequency distribution is given below:

Variable	10–20	20–30	30–40	40–50	50–60	60–70	70–80
Frequency	12	30	f_1	65	f_2	25	18

If Median Value is 46 and total frequency is 229, find the two missing frequencies.[V.U. B.Com.(H) 2007]

[Hints: See worked-out Ex. 12 in Section 4.11. Here $N = 229$, Median = 46, $\frac{N}{2} = 114.5$, Median class is 40–50, $F = 42 + f_1$, $f_m = 65$, $l_1 = 40$, $c = 10$, $f_1 + f_2 = 229 - 150 = 79$. Now apply formulae for Median and fixed the relation $10f_1 = 335$ which gives $f_1 = 34$.]

Problems (B)

1. (a) The monthly incomes of 5 labourers are ₹150, ₹140, ₹165, ₹170 and ₹180. Calculate the Arithmetic Mean and the Geometric Mean.

   (b) The monthly incomes of 6 labourers are (in ₹) 70, 42, 85, 75, 68, 55. Calculate the AM and GM.

   (c) For a moderately asymmetrical distribution, median = 27, mean = 26. Find mode.

   [Hints: Use the formula: Mean − Mode = 3 (Mean − Median). [C.U. B.Com. 2000]]

   (d) Calculate the GM and HM of three numbers 1, 9 and 81.

2. Find the Geometric Mean of the following numbers, correct to two decimal places:

   (a) 90, 25, $\frac{125}{3}$, 81.

   (b) 126, 184, 267, 375, 458. [N.B.U. B.Com. 1997]

3. The price of a certain security in Bombay Stock Exchange on a certain day are given below. Find the median price:

$$100\tfrac{5}{16},\ 100\tfrac{3}{8},\ 100\tfrac{1}{4},\ 100\tfrac{5}{16},\ 100\tfrac{3}{16},\ 100\tfrac{1}{4},\ 100\tfrac{3}{8},\ 100\tfrac{9}{32},$$
$$100\tfrac{11}{32},\ 100\tfrac{1}{16},\ 100\tfrac{1}{8},\ 100,\ 99\tfrac{7}{8},\ 99\tfrac{9}{32},\ 99\tfrac{11}{32},\ 99\tfrac{3}{8},\ 99\tfrac{1}{4}.$$

4. (a) The average weight of the following frequency distribution is 117 lb:

Weight in lb	100	110	120	$x+25$	140	Total
No. of persons	1	4	2	2	1	10

   Find the value of x.

   (b) The mean of 20 observations is 85; but it was later found that two of the observations were wrongly read as 75 and 70 instead of 57 and 60. Find the actual mean.

   Solution: By definition, $\frac{\Sigma x}{20}$ = mean = 85 or, $\Sigma x = 85 \times 20 = 1700$.

   Correct value of $\Sigma x = 1700 - (75+70) + (57+60) = 1672$.

   $\therefore$ actual mean = $\frac{\text{Correct value of } \Sigma x}{20} = \frac{1672}{20} = 83.6$.

   (c) The AM of 25 observations is 44; later on it was reported that two of the observations 34 and 46 were copied as 28 and 42. Find the actual AM.

5. (a) Form a frequency distribution with 8 classes from the following data and work out the mean, the median and the mode from it.

   Data: In a workshop employing 30 persons the daily wages paid are as follows:

(in ₹)									
	2.30,	3.50,	2.30,	2.40,	3.20,	5.10,	4.50,	3.50,	2.30,	3.40
	2.30,	4.50,	5.10,	4.50,	5.50,	2.40,	3.50,	3.20,	2.30,	3.40
	4.50,	2.30,	3.50,	3.20,	2.40,	5.10,	3.40,	2.40,	5.10,	3.40

   [V.U. B.Com. 1997]

(b) The heights of students of a college are given below. Find the median height:

Height in cm	160–163	164–167	168–171	172–175	176–179	180–183	184–187
No. of students	22	80	98	148	104	43	5

[C.U. B.Com. 1994]

6. Find the Mean and the Mode from the following frequency distributions:

(a)

Marks obtained	No. of candidates
0–9	6
10–19	29
20–29	87
30–39	181
40–49	247
50–59	263
60–69	133
70–79	43
80–89	9
90–99	2
Total	1000

(b)

Output in units	No. of workers
300 to 309	9
310 to 319	20
320 to 329	24
330 to 339	38
340 to 349	48
350 to 359	27
360 to 369	17
370 to 379	6

7. (a) Find the Mode from the following distribution:

Marks	1–5	6–10	11–15	16–20	21–25	26–30	31–35	36–40	41–45
No. of candidates	7	10	16	32	24	18	10	5	1

(b) Find the mode of the following frequency distribution. The monthly incomes of 300 workers of a factory are as follows:

Monthly incomes (₹)	1000–1100	1100–1200	1200–1300	1300–1400	1400–1500	1500–1600	1600–1700	1700–1800
No. of workers	16	24	59	100	41	31	19	10

[C.U. B.Com. 1997]

8. (a) Calculate the AM and the Median of the frequency distribution given below. Hence calculate the mode using the empirical relation between the three:

Class-limits	130–134	135–139	140–144	145–149	150–154	155–159	160–164
Frequency	5	15	28	24	17	10	1

[B.U. B.Com. 1990]

(b) Find the Mean and Median of height from the following table:

Height (x cm)	158–161	162–165	166–169	170–173	174–177	178–181	Total
No. of men (f)	11	23	31	18	12	5	100

[V.U. B.Com. 1995]

9. In a small town, a survey was conducted in respect of profit made by retail shops. The following results were obtained:

Profit or Loss in '000 ₹	No. of shops	Profit or Loss in '000 ₹	No. of shops
−4 to −3	4	1 to 2	56
−3 to −2	10	2 to 3	40
−2 to −1	22	3 to 4	24
−1 to 0	28	4 to 5	18
0 to 1	38	5 to 6	10

Calculate: (a) the average profit made by a retail shop; (b) total profit by all shops.

10. (a) Find out the missing frequencies of the following data. AM is 67.45 inches:

Height (inches)	60–62	63–65	66–68	69–71	72–74	Total
No. of students	5	18	f_3	f_4	8	100

[C.U. B.Com. 20

(b) An incomplete frequency distribution is given below:

Variable	10–20	20–30	30–40	40–50	50–60	60–70	70–80	Total
Frequency	15	12	?	56	?	32	18	200

You are given that the median value is 48.93. Using the median formula fill in the missing frequencies.

[V.U. B.Com. 19

(c) Find the missing frequencies in the following frequency distribution when the mean is 11.0

Class-limits	9.3-9.7	9.8-10.2	10.3-10.7	10.8-11.2	11.3-11.7	11.8-12.2	12.3-12.7	12.8-13.2	Total
Frequency	2	5	f_3	f_4	14	6	3	1	80

[C.U. B.Com. 20

11. (a) Form an ordinary frequency table from the following cumulative distribution of marks obtained by 22 students and calculate —

(i) Arithmetic Mean,

(ii) Median,

(iii) Mode.

Marks	No. of students
Below 10	3
Below 20	8
Below 30	17
Below 40	20
Below 50	22

[C.U. B.Com.(H) 1990; V.U. B.Com.(H) 20

(b) Calculate the values of median from the following frequency distribution:

Marks	No. of students
less than 10	160
less than 20	210
less than 30	350
less than 40	480
less than 50	730
less than 60	1000

[C.U. B.Com. 2008 Type]

12. (a) Calculate the quartiles of the following data:

Class-limits	Frequency	Class-limits	Frequency
10–19	5	50–59	25
20–29	9	60–69	15
30–39	14	70–79	8
40–49	20	80–89	4

Find also skewness based on quartiles.

(b) Calculate the quartiles from the following data:

x	4–8	8–12	12–16	16–20	20–24	24–28
f	5	8	18	25	14	10

[C.U. B.Com. 2003]

13. You are given the following incomplete frequency distribution. It is known that the total frequency is 1000 and that the median is 413.11. Estimate by calculation the missing frequencies and find the value of the mode.

Value	Frequency	Value	Frequency
300–325	5	400–425	326
325–350	17	425–450	?
350–375	80	450–475	88
375–400	?	475–500	9

14. (a) Find the Median and Mode from the following table:

Age	20–25	25–30	30–35	35–40	40–45	45–50	50–55	55–60
No. of men	5	70	100	180	150	120	70	60

[C.U. B.Com. 1991]

(b) Determine the Median and Modal Price of the following distribution:

Price of the Commodity (₹)	310–319	320–329	330–339	340–349	350–359	360–369	370–379	380–389	Total
Frequency	5	8	12	28	32	9	7	4	105

[C.U. B.Com. 20

15. You are given below a certain statistical distribution:

Value	Frequency
Less than 100	40
100–200	89
200–300	148
300–400	64
400 and above	39
Total	380

Calculate the most suitable average giving reasons for your choice.

16. The table below gives the number (F) of candidates obtaining marks x or higher in a certain examination (all marks are given in whole numbers):

x	10	20	30	40	50	60	70	80	90	100
F	140	133	118	100	75	45	25	9	2	0

Calculate the mean and the median marks obtained by the candidates.

17. The following table shows the marks in Statistics, secured by 60 students:

Class-interval	0–10	10–20	20–30	30–40	40–50	50–60	60–70
Frequency	5	8	11	15	13	6	2

With the help of a cumulative frequency diagram determine the median mark of the students.

[C.U. B.Com. 20

[Hints: See worked-out Ex. 24 in Section 4.8.1.]

18. Form a frequency distribution with 8 classes of equal class-intervals from the following data and work out the mean, median and mode from it:

Data: In a workshop employing 30 persons the hourly wages paid are as follows:

₹ 2.30, 3.50, 2.30, 2.40, 3.20, 5.10, 4.50, 5.30, 2.30, 3.40,
2.30, 4.50, 5.10, 4.50, 5.50, 2.40, 3.50, 3.20, 2.30, 3.40,
4.50, 2.30, 3.50, 3.20, 2.40, 5.10, 3.40, 2.40, 5.10, 3.40.

[V.U. B.Com. 19