

30/9/2020

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Ch-15

Exercise 15.4

Q.1

715, 724, 725, 710, 729, 745, 694, 699, 696, 712, 734, 728, 716, 705, 719

Descending order -

694, 696, 699, 705, 710, 712, 715, 716, 719, 724, 725, 728, 729, 734, 745

~~n~~ n = 15 (odd)

$$\text{Median} = \frac{n+1}{2} = \frac{15+1}{2} = \frac{16}{2} = 8^{\text{th}} \text{ term}$$

$$= \boxed{716}$$

Q.2

Height	Exclusive	f	cf
160-162	159.5-162.5	15	15
163-165	162.5-165.5	118	133
166-168	165.5-168.5	142	275
169-171	168.5-171.5	127	402
172-174	171.5-174.5	18	~~400~~ 420
		$\Sigma f = 420$	

$$\Sigma f = 420$$

$$\frac{n}{2} = \frac{420}{2} = 210$$

Median class = 275

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 165.5 + \left(\frac{210 - 133}{142} \times 3 \right)$$

$$= 165.5 + \left(\frac{77 \times 3}{142} \right)$$

$$= 165.5 + \frac{231}{142} = 165.5 + 1.627$$

$$= \boxed{167.127}$$

Q.3

IQ	exclusive	f	cf
55-64	54.5-64.5	1	1
65-74	64.5-74.5	2	3
75-84	74.5-84.5	9	12
85-94	84.5-94.5	22	34
95-104	94.5-104.5	33	67
105-114	104.5-114.5	22	89
115-124	114.5-124.5	8	97
125-134	124.5-134.5	2	99
135-144	134.5-144.5	1	100
		$\Sigma f = 100$	

$$\Sigma f = 100$$

$$\frac{n}{2} = \frac{100}{2} = 50$$

$$\text{Median class} = 94.5 - 104.5$$

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 94.5 + \left(\frac{50 - 34}{33} \times 10 \right)$$

$$= 94.5 + \left(\frac{16}{33} \times 10 \right)$$

$$= 94.5 + \frac{160}{33} = 94.5 + 9.45$$

$$= \boxed{99.35}$$

Q.4

Rent	f	cf
15-25	8	8
25-35	10	18
35-45	15	33
45-55	25	58
55-65	40	98
65-75	20	118
75-85	15	133
85-95	7	140
	$\Sigma f = 140$	

$$\Sigma f = 140$$

$$\frac{n}{2} = \frac{140}{2} = 70$$

$$\text{Median class} = 55 - 65$$

$$\text{Median} = L + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 55 + \left(\frac{70 - 58}{40} \times 10 \right)$$

$$= 55 + \frac{120}{40} = 55 + 3 = \boxed{58}$$

Q.5

Marks below	Class	cf	fi
10	0-10	15	15
20	10-20	35	20
30	20-30	60	25
40	30-40	84	24
50	40-50	96	12
60	50-60	127	31
70	60-70	198	71
80	70-80	250	52
			$\Sigma fi = 250$

$$\Sigma f = 250$$

$$\frac{n}{2} = \frac{250}{2} = 125$$

Median class = 50-60

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 50 + \left(\frac{125 - 96}{31} \right) \times 10$$

$$= 50 + \left(\frac{29}{31} \times 10 \right)$$

$$= 50 + \frac{290}{31} = 50 + 9.35$$

$$= \boxed{59.35}$$

Q.6

Age	f	cf
0-10	5	5
10-20	25	30

20-30	p	30+p	05-08
30-40	18	48+p	98-28
40-50	7	55+p	10-08

$$\text{Median} = 24$$

$$\text{Median class} = 20-30$$

$$\frac{n}{2} = \frac{55+p}{2}$$

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$24 = 20 + \left(\frac{\frac{55+p}{2} - 30}{p} \right) \times 10$$

$$24 - 20 = \frac{55+p-60}{2} \times 10$$

$$4 = \frac{p-5}{2p} \times 10$$

$$8p = 10p - 50$$

$$10p - 8p = 50$$

$$2p = 50$$

$$p = \frac{50}{2} = 25$$

$$\boxed{p = 25}$$

Age	Exclusive	f	cf
15-19	14.5-19.5	53	53
20-24	19.5-24.5	140	193
25-29	24.5-29.5	98	291

20-34	29.5-34.5	32	323
35-39	34.5-39.5	12	335
40-44	39.5-44.5	9	344
45-49	44.5-49.5	5	349
50-54	49.5-54.5	3	352
55-59	54.5-59.5	3	355
60 & above	59.5-above	2	357
		$\Sigma f = 357$	

$$\Sigma f = 357$$

$$\frac{n}{2} = \frac{357}{2} = 178.5 \approx 179$$

$$\text{Median class} = 20-24$$

$$\begin{aligned}
 \text{Median} &= l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h \\
 &= 20 + \left(\frac{179 - 53}{128} \times 5 \right) \\
 &= 20 + \frac{126}{28} = 20 + 4.5 \\
 &= \boxed{24.5}
 \end{aligned}$$

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Q. 90

Accidents	f	xf	$fixi$
0	46	46	0
1	p_1	$46 + p_1$	p_1
2	p_2	$46 + p_1 + p_2$	$2p_2$
3	25	$71 + p_1 + p_2$	75
4	10	$81 + p_1 + p_2$	40
5	5	$86 + p_1 + p_2$	25
	$\Sigma f = 200$		$\Sigma fixi = 140 + p_1 + 2p_2$

Mean = 1.46
 $\Sigma f = n = 200$ } given

ATQ,

$$86 + p_1 + p_2 = 200$$

$$p_1 + p_2 = 200 - 86$$

$$p_2 = 114 - p_1 \quad \text{--- (1)}$$

Mean = $\frac{\Sigma fixi}{\Sigma f}$

$$1.46 = \frac{140 + p_1 + 2p_2}{200}$$

$$1.46 \times 200 = 140 + p_1 + 2(114 - p_1)$$

$$292 = 140 + p_1 + 228 - 2p_1$$

$$292 = 368 - p_1$$

$$p_1 = 368 - 292$$

$$p_1 = 76$$

Putting value of p_1 in ①

$$p_2 = 114 - p_1$$

$$p_2 = 114 - 76$$

$$p_2 = 38$$

$$\frac{n}{2} = \frac{200}{2} = 100$$

$$\therefore \text{Median} = 11$$

Q. 11

Variable	f	cf
10-20	12	p_2
20-30	30	42
30-40	p_1	$42 + p_1$
40-50	65	$107 + p_1$
50-60	p_2	$107 + p_1 + p_2$
60-70	25	$132 + p_1 + p_2$
70-80	18	$150 + p_1 + p_2$
	$\Sigma f = 230$ $= 150 + p_1 + p_2$	

$$\left. \begin{array}{l} \text{Median} = 46 \\ \Sigma f = n = 230 \end{array} \right\} \text{given}$$

ATQ,

$$150 + p_1 + p_2 = 230$$

$$p_1 + p_2 = 230 - 150$$

$$p_2 = 80 - p_1 \quad \text{--- ①}$$

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$46 = 40 + \frac{115 - (42 + p_1)}{65} \times 10$$

$$46 - 40 = \frac{115 - (42 + p_1)}{65} \times 10$$

$$6 \times 65 = 1150 - 420 - 10p_1$$

$$390 = 730 - 10p_1$$

$$10p_1 = 730 - 390$$

$$p_1 = \frac{340}{10}$$

$$p_1 = 34$$

Putting value of p_1 in ①

$$p_2 = 80 - p_1$$

$$p_2 = 80 - 34$$

$$p_2 = 46$$

Variable	x_i	f_i	$d_i = x_i - a$	$f_i d_i$
10 - 20	15	12	-30	-360
20 - 30	25	30	-20	-600
30 - 40	35	34	-10	-340
40 - 50	45 = a	65	0	0
50 - 60	55	46	10	460
60 - 70	65	25	20	500
70 - 80	75	18	30	540
		$\sum f_i = 230$		$\sum f_i d_i = 200$

$$\text{Mean} = a + \frac{\sum f_i d_i}{\sum f_i} = 45 + \frac{200}{230}$$

$$= 45 + 0.87 = 45.87$$

Q.12 Mean = 28.5 } given
 $\Sigma f = n = 60$

Class	f	cf
0-10	5	5
10-20	f_1	$5 + f_1$
20-30	20	$25 + f_1$
30-40	15	$40 + f_1$
40-50	f_2	$40 + f_1 + f_2$
50-60	5	$45 + f_1 + f_2$
	$\Sigma f = 45 + f_1 + f_2$	

ATQ,

$$45 + f_1 + f_2 = 60$$

$$f_1 + f_2 = 60 - 45$$

$$f_2 = \cancel{60 - f_1} = 15 - f_1 \quad \text{--- (1)}$$

$$\frac{n}{2} = \frac{60}{2} = 30$$

Median class = 20-30

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$28.5 = 20 + \left[\frac{30 - (5 + f_1)}{20} \times 10 \right]$$

$$28.5 - 20 = \frac{300 - 50 - 10f_1}{20}$$

$$8.5 \times 20 = 300 - 50 - 10f_1$$

$$170 = 250 - 10f_1$$

$$10f_1 = 250 - 170$$

$$f_1 = \frac{80}{10}$$

$$\boxed{f_1 = 8}$$

Putting value of f_1 in ①

$$f_2 = 15 - f_1$$

$$f_2 = 15 - 8$$

$$\boxed{f_2 = 7}$$

13

Class	f
0-100	2
100-200	5
200-300	f_1
300-400	f_2
400-500	17
600-700	20
700-800	
800-900	
900-1000	

13

Class	f	cf
0-100	2	2
100-200	5	7
200-300	f_1	$7 + f_1$
300-400	f_2	$19 + f_1$
400-500	17	$36 + f_1$
500-600	20	$56 + f_1$
600-700	f_2	$56 + f_1 + f_2$
700-800	9	$65 + f_1 + f_2$
800-900	7	$72 + f_1 + f_2$
900-1000	4	$76 + f_1 + f_2$
	$\Sigma f = 76 + f_1 + f_2$	

$$\begin{aligned} \text{Median} &= 525 \\ n = \sum f &= 100 \end{aligned} \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{given}$$

ATQ,

$$76 + f_1 + f_2 = 100$$

$$f_1 + f_2 = 100 - 76$$

$$f_2 = 24 - f_1 \quad \text{--- (1)}$$

$$\text{Median class} = 500 - 600$$

$$\text{Median} = l + \left[\frac{n - cf}{2} \right] \times h$$

$$525 = 500 + \left[\frac{50 - (36 + f_1)}{2} \right] \times \frac{5}{100}$$

$$525 - 500 = 250 - 180 - 5f_1$$

$$25 = 70 - 5f_1$$

$$5f_1 = 70 - 25$$

$$f_1 = \frac{45}{5}$$

$$\boxed{f_1 = 9}$$

Putting value of f_1 in (1)

$$f_2 = 24 - f_1$$

$$f_2 = 24 - 9$$

$$\boxed{f_2 = 15}$$

-14	Class	f	cf
	0-10	1	1
	10-20	5	5 + f ₁
	20-30	9	14 + f ₁
	30-40	12	26 + f ₁
	40-50	f ₂	26 + f ₁ + f ₂
	50-60	3	29 + f ₁ + f ₂
	60-70	2	31 + f ₁ + f ₂
		$\Sigma f = 31 + f_1 + f_2$	

Median = 32.5 } given
 $n = 40$

ATQ, $31 + f_1 + f_2 = 40$
 $f_1 + f_2 = 40 - 31$
 $f_2 = 9 - f_1$ ——— ①

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$32.5 = 30 + \left[\frac{20 - (14 + f_1)}{12} \right] \times 10$$

$$32.5 - 30 = \frac{20 - 14 - 10f_1}{12}$$

$$2.5 \times 12 = 60 - 10f_1$$

$$10f_1 = 60 - 30$$

$$f_1 = \frac{30}{10}$$

$$\boxed{f_1 = 3}$$

Putting value of f_1 in ①

$$f_2 = 9 - 1$$

$$f_2 = 9 - 3$$

$$f_2 = 6$$

Q.15 (i) Less than

Less than	cf	Class	fi
10	0	0-10	0
30	10	10-30	10
50	25	30-50	15
70	43	50-70	18
90	65	70-90	22
110	87	90-110	22
130	96	110-130	9
150	100	130-150	4
			$\Sigma f_i = 100$

$$n = 100$$

$$\frac{n}{2} = \frac{100}{2} = 50$$

$$\text{Median class} = 70-90$$

$$\text{Median} = L + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$= 70 + \left[\frac{50 - 43}{22} \times 20 \right]$$

$$= 70 + \left[\frac{7}{22} \times 20 \right]$$

$$= 70 + \frac{70}{11} = 70 + 6.36$$

$$= 76.36$$

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More than	cf	Class	f
150	0	150-160	8
140	12	140-150	12
130	27	130-140	15
120	60	120-130	35
110	105	110-120	45
100	124	100-110	19
90	141	90-100	17
80	150	80-90	9
			$\Sigma f = 150$

$$\frac{n}{2} = \frac{150}{2} = 75$$

Median class = 110 - 120

$$\begin{aligned}
 \text{Median} &= l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h \\
 &= 110 + \left[\frac{75 - 60}{45} \times 10 \right] \\
 &= 110 + \left[\frac{15}{45} \times 10 \right] \\
 &= 110 + 3.33 = \boxed{113.33}
 \end{aligned}$$

9 Median = 25 } given
 $\Sigma f = n = 170$

class	f	cf
0-10	10	10
10-20	20	30
20-30	p_1	$30 + p_1$
30-40	40	$70 + p_1$
40-50	p_2	$70 + p_1 + p_2$
50-60	25	$95 + p_1 + p_2$
60-70	15	$110 + p_1 + p_2$
$\Sigma f = 110 + p_1 + p_2$		

$$\frac{n}{2} = \frac{170}{2} = 85 \quad \text{Median class} = 30-40$$

ATQ,

$$110 + p_1 + p_2 = 170$$

$$p_1 + p_2 = 170 - 110$$

$$p_2 = 60 - p_1 \quad \text{--- (1)}$$

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$35 = 30 + \left[\frac{85 - (30 + p_1)}{40} \right] \times 10$$

$$35 - 30 = \frac{85 - 30 - p_1}{4}$$

$$5 \times 4 = 55 - p_1$$

$$p_1 = 55 - 20$$

$$\boxed{p_1 = 35}$$

Putting value of p_1 in (1)

$$p_2 = 60 - p_1$$

$$p_2 = 60 - 35$$

$$p_2 = 25$$

20 Median = 14.4 } given
 $\Sigma f = n = 20$

Class	f	cf
0-6	4	4
6-12	x	4+x
12-18	5	9+x
18-24	y	9+x+y
24-30	1	10+x+y
	$\Sigma f = 10+x+y$	

$$n = 20$$

$$\text{Median class} = 12-18$$

$$\frac{n}{2} = \frac{20}{2} = 10$$

ATQ,

$$10+x+y = 20$$

$$x+y = 20-10$$

$$y = 10-x \quad \text{--- (1)}$$

$$\text{Median} = l + \left[\frac{\frac{n}{2} - cf}{f} \right] \times h$$

$$14.4 = 12 + \left[\frac{10 - (4+x)}{5} \right] \times 6$$

$$14.4 - 12 = \frac{60 - 24 - 6x}{5}$$

$$2.4 \times 5 = 36 - 6x$$

$$6x = 36 - 12$$

$$6x = 24$$

$$\boxed{x = 4}$$

Putting value in ①

$$y = 10 - x = 10 - 4$$

$$\boxed{y = 6}$$

Q.21 Median = 50, $n = \sum f = 90$ (given)

Marks	f	cf
20-30	~~5~~	~~p~~
30-40	15	15+p
40-50	~~20~~ 25	40+p
50-60	~~10~~ 20	60+p
60-70	~~10~~ q	60+p+q
70-80	8	68+p+q
80-90	10	78+p+q
	$\sum f = 78+p+q$	

$$\frac{n}{2} = \frac{90}{2} = 45$$

Median class = 50-60

ATQ,

$$78+p+q = 90$$

$$p+q = 90 - 78$$

$$q = 12 - p \quad \text{--- ①}$$

$$\text{Median} = l + \left[\frac{n/2 - cf}{f} \right] \times a$$

Putting value of p

$$50 - 50 = \frac{45 - 40 - p}{2} \times 10$$

$$q = 12 - p$$

$$q = 12 - 5$$

$$\boxed{q = 7}$$

$$0 = 45 - 40 - p$$

$$\boxed{p = 5}$$