2. Statistics II

1			

X	0	1	2	3	4	5
f	20	8	6	4	1	1
fx	0	8	12	12	4	5
fx^2	0	8	24	36	16	25

$\sum f = 40 \quad \sum fx = 41 \quad \sum fx^2 = 109$

$$s.d = \sqrt{\frac{109}{40} - \left(\frac{41}{40}\right)^2}$$

$$= \sqrt{2.725 - 1.050625}$$

$$= \sqrt{1.674375}$$

$$= 1.294$$

	M_1	fx
	M_1	fx^2
	M_1	
	A_1	Allow 1.293976429
	4	

1.

Mass kg	*Mid term x*	*F*	*d = x A*	*fd*	d^2	fd^2
50 - 54	*52*	*19*	*-15*	*-285*	*225*	*4275*
55 - 59	*57*	*23*	*-10*	*-230*	*100*	*2300*
60 - 64	*62*	*40*	*-5*	*-200*	*25*	*1000*
65 - 69	*67*	*28*	*0*	*0*	*0*	*0*
70 - 74	*72*	*17*	*5*	*85*	*25*	*425*
75 - 79	*77*	*9*	*10*	*90*	*100*	*900*
80 - 84	*82*	*4*	*15*	*60*	*225*	*900*
		Σf = 140		*Σfd = -480*		*Σfd = 9800*

Marks awarded for √table as follows:-
Σf = 140 BI
Column for d B1
Column for fd B1
Σfd = - 480 B1
√Column for d^2 = 9800 B_1
Σfd = 9800B_1

$$\bar{x} = A + \frac{\Sigma fd}{\Sigma f}$$

$$= 67.0 + -\frac{480}{140}$$

= 67.0 – 3.43 = 63.57 …… M1
= 63.6 kg …… A1

$$\text{Standard deviation} = \frac{\Sigma fd^2}{\Sigma f} - \frac{\Sigma fd}{\Sigma f}$$

$= \sqrt{\frac{9800}{140} - (3.43)^2}$

$= \sqrt{58.24} = 7.631$

$= 7.6$

2. $= {}^{8}/_{150} + {}^{6}/_{150} + {}^{9}/_{300} + {}^{3}/_{300}$

$= {}^{40}/_{300} = {}^{2}/_{15}$

a) Construction of AB B1
Construction of BC B1
Construction of AC B1

b) Construction of bisect of AC B1
Construction of bisect BC B1
Radius 3.6 cm B1

c) Construction of bisect < CAB B1 OC B1
Construction of AD B1 AD = 12.8cm B1

3. a)

Class	f	x	d = A – x	fd	d^2	fd^2
41 – 50	20	45.5	15	300	225	4500
51 – 55	60	53	7.5	450	56.25	3375
56 – 65	60	60.5	0	0	0	0
66 – 70	50	68	-7.5	-375	56.25	2812.50
71 – 85	15	73	-12.5	187.5	156.25	2343.75
				$\sum fd$ 562.5		$\sum fd^2$ 13031.25

b) $S = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$

$S = \sqrt{\frac{13031.25}{205} - \left(\frac{562.5}{205}\right)^2}$

$= \sqrt{63.567 - 7.529}$

$= \sqrt{56.038}$

$= 7.486$

4. $15\,(ax)^4\,({}^{-2}/_{x^2}) = 4860$

$60a^4 = 4860$
$a^4 = 81$
$a = 3$

5.

Marks(x)	Freq.(f)	fx	d=x-x	d^2	Fd^2
5.5	1	5.5	-40.45	1636	1636
15.5	6	99	-30.45	927.2	5563
25.5	10	255	-20.45	418.2	4182
35.5	20	710	-10.45	109.2	2184
45.5	15	682.5	-0.45	0.2025	3038
55.5	5	277.5	9.55	91.20	456
65.6	14	917	19.55	382.2	535
75.5	5	377.5	29.55	873.2	4366
85.5	3	256.5	39.55	1564	4692
95.5	1	95.5	49.55	2455	2455
	$\sum f=80$	$\sum f99x=3676$			$\sum fx^2 33,923$

$$\text{Mean} = \frac{\sum fx}{\sum f} = \frac{3676}{80}$$

$$= 45.95$$

$$(b)\ Q1 = 30.5 + \frac{3}{14} \times 10$$

$$= 62.64$$

$$S.I.R = \tfrac{1}{2}(62.64 - 32)$$

$$= 15.32$$

(c) Standard deciation

$$= \sqrt{\frac{\sum fd^2}{\sum f}} = \frac{33923}{80}$$

$$= 20.59$$

6. a) $x = 90 - (2 + 13 + 51 + 27 + 14 + 1)$

$= 90 - 84 = 6$

b) $15 - 19$

c) i)

Class	x	f	D= x-A	fd	D^2	Fd^2
5-9	7	2	-15	-30	225	450
10-14	12	13	-10	-130	100	1300
15-19	17	31	-5	-155	25	775
20-24	22	23	0	0	0	0
25-29	27	14	5	70	350	4900
30-34	32	6	10	60	600	3600
35-39	37	1	15	15	225	225

$Ef = 90 \quad Efd = 170 \quad Efd^2 = 11250$

$$\text{Mean} = \frac{E + d}{Ef} + A$$

$$= \frac{-170}{90} + 22$$

$$= 22 - 1.888 = 20.11$$

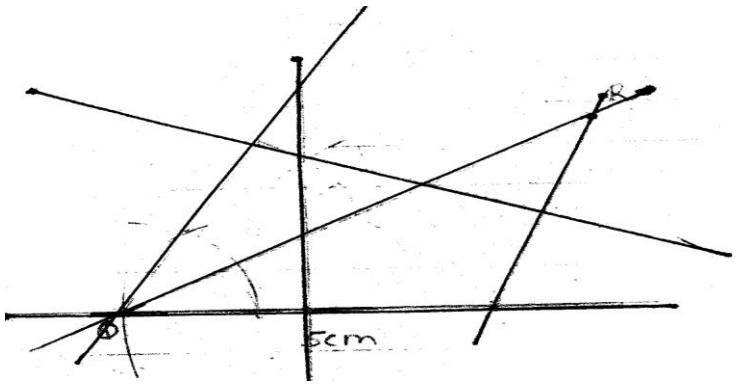
ii) $S.d = \sqrt{\frac{Efd}{Ef} - \left[\frac{Efd}{Ef}\right]^2}$

$$= \sqrt{122 - (-1.888)^2}$$

$= \sqrt{125 - 3.566} \quad = \sqrt{121.4}$

$= 11.02$

7.



$RQ = 7.5 \pm 0.1$

$< PRQ\ 40° \pm 1$

B1 circle through P, Q and R

d) $r = 4.1 \degree 0$

$A = \pi r^2$

$^{22}/_{7} \times 4.1 \times 4.1 = 52.83$

8.

Class limits	*f*	*cf*
-0.5 – 19.5	*7*	*7*
19.5- 39.5	*21*	*28*
39.5 – 59.5	*38*	*66*
59.5 – 79.5	*27*	*93*
79.5 -= 99.5	*7*	*100*

i) from the curve – median = 52. M1 A1

(ii) Inter quartile range = 66-38 = 28.

(iii) 7th 7/10 = 62.46marks

(iv) 60th percentile – 56.34

9. $25^2 + 24^2 + 22^2 + 23^2 + x^2 + 262 + 21^2 + 23^2 + 22^2 + 27^2 = 5154$

$5.625 + 576 + 2(484) + 2(529) + 676 + 441 + 729 + x2 = 5154$

$X^2 = 81$

$X = 9$

- *(ii)* $X = \frac{222}{10} = 22.2$
- $\Sigma(X - x)^2 = 2.8^2 + 1.8^2 + 0.22 + 0.8^2$

  $13.2^2 + 3.8^2 + 1.22 + 0.8^2 + 0.2^2 + 4.8^2$
- $(x\text{-}x)^2 = 7.84 + 3.24\ 2(0.04) + 2(0.64)$

  $+174.24 + 14.44 + 1.44 + 23.04$

  $= \frac{225.6}{10}$

  s.d 22.56

  $= 4.75$

(b) (i) New mean = 22.2 + 3

$= 25.2$

(ii) s.d = 4.75

10. a) i) $x = A + \frac{\sum fd}{\sum f}$

$= 45.6 + \frac{(-74)}{40}$

$= 43.75$

Class	*Mis-pt x*	*d = (x – A)*	*Frequency f*	*fd*	Fd^2
1 – 10	*5.5*	*-40.1*	*1*	*-40.1*	*1608.01*
11 – 20	*15.5*	*-30.1*	*3*	*-90.3*	*8154.05*
21 – 30	*25.5*	*-20.1*	*4*	*-80.4*	*6464.16*
31 – 40	*35.5*	*-10.1*	*7*	*-70.7*	*4998.49*
41 – 50	*45.5*	*-0.1*	*12*	*-1.2*	*1.44*
51 – 60	*55.5*	*9.9*	*9*	*89.1*	*7938.81*
61 – 70	*65.5*	*19.9*	*2*	*39.8*	*1584.04*
71 – 80	*75.5*	*29.9*	*1*	*29.9*	*894.01*
81 – 90	*85.5*	*39.9*	*0*	*0*	*0*
91 – 100	*95.5*	*49.9*	*1*	*49.9*	*2410.01*

i) Standard Deviation

$D = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$

$= 10\sqrt{\frac{34135.11}{40} - \left(\frac{-74}{40}\right)^2}$

10 x 29.1531 = 29.1531

b) 30^{th} *student =* 10^{th} *from bottom*

$30.5 + \left(\frac{10 - 8}{7}\right)10$

= 30.5 + 2.9 = 33.4 marks.

11. a) Mean $45.5 + \frac{530}{60}$

$= 54.33$

(b) Median $= 50.5 + \left(\frac{30.5 - 23}{14}\right) 10$

$= 55.86$

(c) Standard deviation = $\sqrt{\left(\frac{2300}{60}\right)^2 - \frac{530}{60}}$

= 17.52

(d) Modal class 51 – 60

12.

x	f	d	d2	fd	fd2
24.5	4	-30	900	-120	3600
34.5	26	-20	400	-520	10400
44.5	72	-10	100	-720	7200
54.5	53	0	0	0	0
64.5	25	10	100	250	2500
74.5	9	20	400	180	3600
84.5	11	30	900	330	9900
	200			-600	37200

(a) (i) Mean = $A + \frac{\Sigma fd}{\Sigma f}$

$= 54.5 - \frac{600}{200}$

$= 51.5$

(ii) Standard deviation

$= \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \frac{\Sigma fd^2}{\Sigma f}}$

$= \sqrt{\frac{37200}{200} - (-3)^2}$

$= \sqrt{186 - 9}$

$\simeq 13.30$

(b) $Q_1 = 39.5 + \frac{50 - 30}{72} \times 10$

$= 42.28$

$Q_3 = 49.5 + \frac{150-102}{53} \times 10$

$= 58.56$

$Q_3 - Q1 = 58.56 - 42.28$

$= 16.28$