1. (a) Mode of the distribution is 38.

$$38 = \frac{21 + 22 + \ldots + 69}{18} \qquad \text{1M}$$

$$2h + 2k = 20$$

The inter-quartile range is one third of the range.

$$(40 + k) - (20 + h) = \frac{69 - 21}{3} \qquad \text{1M}$$

$$k - h = -4$$

Solving, we have $h = 7$ and $k = 3$. 1A+1A

(b) (i) Original median is 38.

New median is the 10th datum, which is also 38. 1M

There is no change in the median of the distribution. 1A

(ii) Let $x$ be the numbers of Chinese characters typed by the newly added student in one minute.

<u>Case 1: $x = 20$</u>

Standard deviation $\approx 12.9$

<u>Case 2: $x = 70$</u>

Standard deviation $\approx 14.1$

The least possible standard deviation is 12.9. 1M

Thus, it is impossible that the standard deviation of the distribution is less than 12.7. 1A

2. (a) Median of the distribution is 25.

$$20 + b = 25$$

$$b = 5 \qquad \text{1A}$$

Inter-quartile range of the distribution is 18.

$$\frac{33 + 35}{2} - \frac{(10 + a) + (10 + a)}{2} = 18 \qquad \text{1M}$$

$$a = 6 \qquad \text{1A}$$

$$\text{Mean} = \frac{11 + 12 + \ldots + 48}{25}$$

$$= 25.96 \qquad \text{1A}$$

(b) (i) The datum 48 is deleted. 1A

(ii) 9.95 1A

3. (a) The range of the distribution is 25.

$$78 - (50 + a) = 25 \qquad \text{1M}$$

$$a = 3$$

Mean = $\frac{53 + 53 + \ldots + 78}{30}$ = 65 g 1A

Mode = 72 g 1A

(b) Required probability $= \frac{26}{30}$ 1M

$= \frac{13}{15}$ 1A

4. (a) $47 = (50 + c) - (10 + a)$ 1M

$c - a = 7$

$33 = \frac{(10 + a) + 14 + 18 + \ldots + (50 + c)}{18}$ 1M

$a + b + c = 10$

Since $0 \le a \le 4$, $0 \le b \le 3$ and $7 \le c \le 9$, we have

$(a,\ b,\ c) = (0,\ 3,\ 7)$ or $(1,\ 1,\ 8)$. 1A

(b) Required probability $= \frac{10}{18}$ 1M

$= \frac{5}{9}$ 1A

5. (a) $(50 + b) - 21 = 32$ 1M

$b = 3$ 1A

$37 - (20 + a) = 9$

$a = 8$ 1A

Mean of the distribution $= \frac{21 + 23 + \ldots + 53}{18} = 33.5$ 1A

Standard deviation of the distribution $\approx 8.73$ 1A

(b) Original median of the distribution = 33

Age of the new teacher = 33 1A

Change in standard deviation $\approx 8.49 - 8.73$

$\approx -0.232$ 1A

6. (a) Median = 70 kg 1A

$69 = \frac{(50 + a) + 57 + 58 + \ldots + (80 + b)}{15}$ 1M

$3a + b = 9$

$(80 + b) - (50 + a) = 35$ 1M

$b - a = 5$

Solving, we have $a = 1$ and $b = 6$. 1A

Inter-quartile range = 75 − 61

= 14 kg 1A

(b) Weight of the new student is 75 kg. 1M

New standard deviation is 9.33 kg. 1A

7. (a) Interquartile range $= 2.8 - 1.9$ 1A

$= 0.9\text{ h}$ 1A

(b) (i) $m = 2.4$ 1A

$n = 1.1 + 2.0 = 3.1$ 1A

(ii) The interquartile range of John's running time (0.9 hours) is smaller than that of Peter's running time (1.1 hours). 1M

John should be chosen. 1A

(iii) According to the past performance,

probability of John to break the record $= \frac{5}{19}$; 1A

probability of Peter to break the record $\leq 0.25 < \frac{5}{19}$.

John should be chosen. 1A

8. (a) Mean = 6.4 1A

Median = 6.5 1A

Mode = 5 and 8 1A

(b) (i) $\frac{50 \times 6.4 + 15n}{50 + 15} = 6.4 + 0.6$ 1M

$n = 9$ 1A

(ii) Least possible mode is 4. 1A

Greatest possible mode is 9. 1A

9. (a) Range $= 13.1 - 1.8$ 1M

$= 11.3\text{ g/100mL}$ 1A

Interquartile range $= 9.2 - 5.4$

$= 3.8\text{ g/100mL}$ 1A

(b) New mean $= \frac{7.2 \times 20 + 2.4 + 4.6 + 7.5 + 10.4 + 13.4}{20 + 5}$ 1M

$= 7.292\text{ g/100mL}$ 1A

New median is the 13th datum in ascending order.

New median is 7.5 g/100mL. 1M+1A

10. (a) $\frac{13 + x + 2}{32} = \frac{9}{16}$ 1M

$x = 3$ 1A

$y + 13 + x + 2 = 32$

$y = 14$ 1A

(b) 0.856 1A

11. (a) (i) The mean of the data is 20 cm.

$$\frac{18 + 23 + \ldots + x}{8} = 20 \quad \text{1M}$$

$$x = 19 \quad \text{1A}$$

(ii) Range = 26 − 13 = 13 cm 1A

Mode = 26 cm 1A

(b) (i) Least possible value $= \frac{14 + 18}{2}$ 1M

$= 16$ cm 1A

Greatest possible value $= \frac{23 + 26}{2}$

$= 24.5$ cm 1A

(ii) 26 cm, 26 cm, 26 cm and 26 cm. 1A

12. (a) $\frac{x}{360°} = \frac{18}{48}$ 1M

$x = 135°$ 1A

(b) Inter-quartile range = 2 1A

Standard deviation ≈ 1.11 1A

13. (a) Median = 26.5 min 1A

Range = 42.3 − 16.8 = 25.5 min 1A

(b) Let $t$ minutes be the time taken by the new student.

$$28 \times 35 + t = (28 - 0.3) \times 36$$

$$t = 17.2 \quad \text{1A}$$

Range = 42.3 − 16.8 = 25.5 1M

The claim is not correct. 1A

14. (a) Range = 44 − 14 = 30 1M

Inter-quartile range $= (30 + b) - 19 = 11 + b$ 1M

$$30 = 2(11 + b)$$

$$b = 4 \quad \text{1A}$$

(b) (i) The mean of the distribution is at least 27.

$$\frac{14 + 15 + \ldots + 44}{19} \geq 27 \quad \text{1M}$$

$$a \geq 2$$

The least possible value of $a$ is 2. 1A

(ii) Mean age of two new trees $= \frac{18 + 32}{2}$ 1M

$= 25$

Since $25 < 27$, the new mean of the ages of the trees in the garden must be decreased.
The claim is agreed. 1A

15. (a) $2a - (a - 32) = 4(118 - a)$ 1M

$a = 88$

Lower quartile is \$88. 1A

Range $= 2a - (a - 32)$

$= \$120$ 1A

(b) $\dfrac{219\,468 + 102 \times 92 + 54h + 54k}{2017 + 210} \geq 108$ 1M

$k \geq 216 - h$

Note that $h \leq 110$.

$k \geq 216 - 110$

$k \geq 106$

The values of $h$ and $k$ are greater than 105. 1M

There are 108 (54 + 54) new books with selling prices greater than \$105.

There are 102 new books with selling prices less than \$105.

The new median of the selling prices is not less than the median before adding 210 new books. 1M

The new median is not less than \$105.

The claim is disagreed. 1A

16. (a) Median = 4 1A

Inter-quartile range $= 6 - 2$

$= 4$ 1A

Standard deviation $\approx 1.99$ 1A

(b) (i) 8 1A

(ii) 31 1A

17. (a) Median = 64 1A

Range $= 84 - 40 = 44$ 1A

Inter-quartile range $= 75 - 54 = 21$ 1A

(b) (i) The new inter-quartile range $= 80 - 55 = 25 > 21$. 1M

No. The distribution is not less dispersed than that in the first term. 1A

(ii) Number of students who get Grade $A$ in the first term is 2.

In the second term, it is possible that the highest six scores are

80 80 80 80 80 88

such that the upper quartile and the maximum are 80 and 88 respectively.

In this case, number of students who get Grade $A$ is 1, which is not 3 more than that in the first term. 1M

The claim is incorrect. 1A

18. (a) Range = 180 − 152 = 28 cm — 1M

$$2[(170 + a) - 161] = 28$$ 1M

$$a = 5$$ 1A

(b) Mean is 167.6 cm. — 1A

Standard deviation is 8.24 cm. — 1A

19. (a) Mean = 4.5 — 1A

Mode = 4 — 1A

Inter-quartile range = 3 — 1A

(b) Required probability $= 1 - \frac{8}{8+9+2+7+2}$ — 1M

$= \frac{5}{7}$ — 1A

20. (a) (i) Mode = 39

Thus, $a = b = 9$. — 1A

(ii) $\frac{(50+c)+51}{2} - \frac{(30+d)+30}{2} = 21$ — 1M

$c - d = 1$

Range $= (60+d) - (20+c)$

$= 40 - (c-d)$

$= 39$ — 1A

(b) Mean $= \frac{(20+c)+25+26+\ldots+(60+d)}{20}$ — 1M

$= \frac{830+2(c+d)}{20}$

Since $c - d = 1$, $1 \le c \le 5$ and $2 \le d \le 5$, we have $3 \le c + d \le 9$. — 1M

$\frac{830+2(3)}{20} = 41.8 \le \text{mean} \le \frac{830+2(9)}{20} = 42.4$

Thus, mean = 42 and $c + d = 5$. — 1A

Solving, we have $c = 3$ and $d = 2$.

Standard deviation ≈ 11.9 — 1A

21. (a) Let $\bar{x}$ be the mean of the scores of the examination.

$\frac{71-\bar{x}}{6} = 1.5$ — 1M

$\bar{x} = 62$ — 1A

(b) Score of David = 62 − 2.5(6) = 47 — 1M

Range of scores ≥ 71 − 47 = 24 > 23

The claim is disagreed. — 1A

22. (a) $y = 7$ 1A

$67 - \frac{1}{2}[(40 + x) + 51] = 18$

$x = 7$ 1A

(b) Mean $= \frac{34 + 35 + \ldots + 83}{20}$

$= 58$

Standard deviation $= \sigma \approx 13.5$

Required standard score $= \frac{62 - 58}{\sigma}$ 1M

$\approx 0.296$ 1A

(c) Sum of the two deleted data $= 58 \times 2 = 116$

The only possible set of deleted data is $\{42, 74\}$. 1M

In this case, new standard deviation is 13.2, which is lower than the original standard deviation.

The new mean is also 58.

Thus, the new standard score increases. 1M

The claim is disagreed. 1A

23. (a) Let $\overline{x}$ marks and $\sigma$ marks be the mean and standard deviation of the scores respectively.

$$\begin{cases} 0 = \dfrac{68 - \overline{x}}{\sigma} \\ -1.5 = \dfrac{50 - \overline{x}}{\sigma} \end{cases}$$ 1M

Solving, we have $\overline{x} = 68$ and $\sigma = 12$. 1A+1A

(b) The mean of the scores remains unchanged, while the standard deviation of the scores increases. 1M

Cindy's standard score increases.

The claim is correct. 1A

24. Let $\$\mu$ and $\$\sigma$ be the mean and the standard deviation of the salaries respectively.

Let $\$C$ and $\$J$ be the salaries of Chris and John respectively.

We have $C - J = 3000$. 1M

$$\frac{C - \mu}{\sigma} - \frac{J - \mu}{\sigma} = 1 - (-2)$$ 1M

$$\frac{C - J}{\sigma} = 3$$

$$\frac{3000}{\sigma} = 3$$

$$\sigma = 1000$$ 1A

Variance $= 1000^2$

$= \$1\,000\,000$ 1A

25. (a) $\dfrac{13 - x}{2} = 1.5$ 1M

$x = 10$ 1A

(b) The mean score of the 3 new people is also 10.

$$\frac{p + (p + 1) + (p + 5)}{3} = 10$$ 1M

$$p = 8$$

The scores of these 3 people are 8, 9 and 13.

There are 2 people with scores lower than the mean.

Thus, 2 people have negative standard score. 1A

26. Let $\sigma$ be the standard deviation of the scores.

$$-3.5 = \frac{28 - 70}{\sigma}$$ 1M

$$\sigma = 12$$

Highest possible score of a student

$= 72 + 28$

$= 100$ 1A

Greatest possible standard score of a student

$= \dfrac{100 - 70}{12}$

$= 2.5$

The standard score of a student cannot exceed 2.5. 1A

27. (a) Let the mean and standard deviation of the distribution be $\mu$ and $\sigma$ respectively.

$$\begin{cases} \dfrac{60 - \mu}{\sigma} = 1.25 \\ \dfrac{44 - \mu}{\sigma} = 0.25 \end{cases}$$ 1M

Solving, we have $\mu = 40$ and $\sigma = 16$. 1A+1A

(b) New standard score of Carol $= \dfrac{44(1 + 10\%) - 40(1 + 10\%)}{16(1 + 10\%)}$ 1M

$= 0.25$

The claim is not correct. 1A

28. (a) Let $\mu$ minutes be the mean of the distribution.

$$\frac{190 - \mu}{20} + \frac{240 - \mu}{20} = 0.5$$ 1M

$$\mu = 210$$ 1A

The mean is 210 minutes.

(b) The median is 220 minutes, which is greater than the mean (210 minutes). 1M

The claim is agreed. 1A

29. (a) Standard score $= \dfrac{74 - 64}{4}$ 1M

$= 2.5$ 1A

(b) Standard score of Samuel after the adjustment

$= \dfrac{74(1 + 10\%) - 64(1 + 10\%)}{4(1 + 10\%)}$ 1M

$= 2.5$

$< 2.75$

Sophia performs better in the test. 1A

30. (a) $\dfrac{3.1 + (0.1 - k) + (0.1 + k) + k}{4} = 0$ 1M

$k = -3.3$ 1A

(b) Let $\sigma$ marks be the standard deviation of the scores of the students.

$0.1 - (-3.3) = \dfrac{74 - 40}{\sigma}$

$\sigma = 10$ 1A

Standard score of Peter $= \dfrac{72 - 40}{10}$

$= 3.2$

$> 3.1$

The claim is incorrect. 1A

31. A

I. ✓.

Inter-quartile range = 20 − 17 = 3

II. ✗.

Mean cannot be obtained from the diagram.

III. ✓.

Median is 19, which is greater than 18.

32. B

50% of the data lies between lower quartile and upper quartile.

33. B

$70 - 40 = 3(a - 48)$

$a = 58$

34. D

Mean $= 6 = \dfrac{2+4+6+6+x+x+x+y}{8}$

$3x + y = 30$

The only possible cases are $(x,\ y) = (6,\ 12)$ or $(8,\ 6)$ or $(9,\ 3)$.

I. ✗.

Take $x = 9$ and $y = 3$.

The mean and the median is 6, while the mode is 9.

II. ✓.

| $(x,\ y)$ | $(6,\ 12)$ | $(8,\ 6)$ | $(9,\ 3)$ |
|---|---|---|---|
| Range | 10 | 6 | 7 |

The greatest possible range is 10.

III. ✓.

| $(x,\ y)$ | $(6,\ 12)$ | $(8,\ 6)$ | $(9,\ 3)$ |
|---|---|---|---|
| Variance | 7 | 4 | 7 |

The least possible variance is 4.

35. B

Upper quartile = \$40

Angle of sector \$10 $= 360° - 72° - 36° - 90° - 144° = 18°$

Lower quartile $= \dfrac{20+30}{2} =$ \$25

Inter-quartile range $= 40 - 25 =$ \$15

36. B

Required number $= \dfrac{1}{4} \times 40$

$= 10$

37. B

The upper quartile of the distribution is 210 g.

Required probability $= \dfrac{7}{24}$

38. D

In the cumulative frequency curve, steeper curve represents more data in the corresponding class.
The data is more concentrated in the lower part.
Minimum, lower quartile, median and upper quartile will be closed to each other.

39. B

I. ✗.
The range of two classes are 50.

II. ✓.
The median of scores in class 6A is 57, while the median of scores in class 6B is 72.

III. ✗.
The inter-quartile range of scores in class 6A is 20, while the inter-quartile range of scores in class 6B is 10.

40. C

Number of data = 8 + 6 + 6 + 4 + 6 = 30

$$\text{Inter-quartile range} = 9 - 3 = 6$$

41. D

A. ✗. Mode of the distribution is 8.

B. ✗. $\text{Mean} = \dfrac{5(3) + 6(4) + 7(23) + 8(50) + 9(40)}{3 + 4 + 23 + 50 + 40} = 8$

C. ✗. Median of the distribution is 8.

D. ✓. $\text{Inter-quartile range} = 9 - 7.5 = 1.5$

42. C

Since the median is 8, we have $x = 8$ or $y = 9$.
Since the mode is 15, then the values of $x$ and $y$ are 8 and 15.
Suppose $x = 8$ and $y = 15$.

$$\text{Mean} = \frac{8 + 2 + 3 + \ldots + 15}{10} = 8.5$$

43. A

Steeper curve represents more data in the corresponding class.
In distribution $X$, the data is more concentrated in both upper and lower parts.
The standard deviation is greater.
In distribution $Z$, the data is more concentrated in the middle part.
The standard deviation is smaller.

44. D

A. ✗.
The median is 1.

B. ✗.
The lower quartile is 0.

C. ✗.
The mode is 0.

D. ✓.

45. A

I. ✓.
Range of $A = 74 - 52 = 22$
Range of $B = 72 - 42 = 30 > 22$

II. ✗.
Mean of $A$ cannot be obtained from the diagram.

III. ✗.
Upper quartile of $A = 69$
Upper quartile of $B = 64 < 69$

IV. ✗.
Median of $A = 67$
Median of $B = 57 < 67$

46. B

The mode is 30. At least two of the unknowns equal 30.
Take $a = b = 30$.
The median is 23.

$$\frac{21 + c}{2} = 23$$

$$c = 25$$

Inter-quartile range $= 30 - 12$

$= 18$

47. D

I. ✓.

II. ✗.

$$q = (50 + p) - 42$$

$$q - p = 8$$

III. ✓.

Since $2 \le p \le 5$ and the inter-quartile range is $q = p + 8$.

We have $10 \le q \le 13$.

48. B

$2 + 10 + 14 + m + 2 = 40$

$m = 12$

$n - 1 = 5$

$n = 6$

We have $x = 3$ and $z = 3$.

$$y = \frac{1(2) + 2(10) + 3(14) + 4(12) + 6(2)}{40}$$

$= 3.1$

49. B

I. ✗.

Take $x = 0$. The means of two groups of numbers are $-1$ and $-\frac{1}{6}$ respectively.

II. ✓.

The medians of two groups are both $x - 1$.

III. ✗.

Take $x = 0$.

Inter-quartile range of the first group $= 1 - (-4) = 5$

Inter-quartile range of the second group $= 2 - (-4) = 6$

50. A

I. ✗. It may happen that the 58 kg person gains weight after training.

II. ✓. The new maximum is 3 kg less than the original upper quartile.

At least 25% of the members have lost 3 kg or more.

III. ✗. It may happen that the 90 kg person becomes 53 kg after training.

51. A

I. ✓.
The standard score of Mary is higher.

II. ✓.
Difference between Mary's score and the mean is $0.8\sigma$, where $\sigma$ is the standard deviation.
Difference between John's score and the mean is $1.05\sigma$, which is greater than $0.8\sigma$.

III. ✗.
There is no information about the distribution.
This may not be true.

52. C

Upper limit of his standard score

$$= \frac{100 - 60}{10}$$

$= 4$

Lower limit of his standard score

$$\frac{98 - 68}{10}$$

$= 3$

Denote the standard score of Leo by $z$.

We have $3 < z < 4$.

The answer is C.

53. B

The variance of $\{-a, 1, 3, a\}$ is also equal to $b^2 - 2$.

The variance of $\{-2a, 2, 6, 2a\}$ is also equal to $14b$.

$$14b = 2^2(b^2 - 2)$$

$$0 = 4b^2 - 14b - 8$$

$$b = 4 \quad \text{or} \quad -\frac{1}{2} \text{ (rejected)}$$

54. D

Let $\sigma$ marks be the standard deviation of the test scores.

$$\frac{78 - 66}{\sigma} = 2$$

$$\sigma = 6$$

The mean and standard deviation of the test scores after the adjustment are 60 marks and 6 marks respectively.

Required standard score $= \dfrac{72 - 60}{6}$

$= 2$

55. **C**

Let $\sigma$ be the standard deviation.

$$1.5 = \frac{72 - 60}{\sigma}$$

$$\sigma = 8$$

Required standard score $= \dfrac{42 - 60}{8}$

$= -2.25$

56. **B**

Let $\mu$ marks and $\sigma$ marks be the mean and the standard deviation of the scores.

$$\begin{cases} \dfrac{82 - \mu}{\sigma} = 1.5 \\ \dfrac{58 - \mu}{\sigma} = -2.5 \end{cases}$$

Solving, we have $\mu = 73$ and $\sigma = 6$.

Required standard score $= \dfrac{70 - 73}{6}$

$= -0.5$

57. **A**

Let $\mu$ and $\sigma$ be the mean and the standard deviation of the test scores.

Let $C$ and $D$ be the test scores of Connie and David respectively.

$$\frac{C - \mu}{\sigma} - \frac{D - \mu}{\sigma} = 3 - (-0.5)$$

$$\frac{C - D}{\sigma} = 3.5$$

$$\frac{14}{\sigma} = 3.5$$

$$\sigma = 4$$

58. **A**

I. ✓.

II. ✗.

Take $d = -1$.

The mean of $G_1$ is 4, while the mean of $G_2$ is $-4$.

III. ✗.

Take $d = 0.5$.

The range of $G_1$ is 6, while the range of $G_2$ is 3.

59. D

I. ✗. New median $= (m + 7) \times 4 = 4m + 28$

II. ✗. New variance $= 4^2 v = 16v$

60. A

I. ✓.

The range of $S_2$ is equal to the range of $\{p, q, r, s, t, m\}$, which is equal to the range of $S_1$.

II. ✗.

The mean of $S_2$ is $m + 2$, while the mean of $S_1$ is $m$.

III. ✗.

Take $p = 1, q = 2, r = 3, s = 4, t = 5$.

The variance of $S_1$ is 2.

The variance of $S_2$ is $\frac{5}{3}$.

61. D

Let $\mu$ and $\sigma$ be the mean and the standard deviation of the test scores respectively.

$$\begin{aligned}\frac{m}{n} &= -\frac{3}{2} \\ \frac{67-\mu}{\sigma} \div \frac{82-\mu}{\sigma} &= -\frac{3}{2} \\ \frac{67-\mu}{82-\mu} &= -\frac{3}{2} \\ 134 - 2\mu &= -246 + 3\mu \\ \mu &= 76\end{aligned}$$

62. B

Let $\mu$ and $\sigma$ be the mean and the standard deviation of the test scores respectively.

$$\begin{cases} \dfrac{54-\mu}{\sigma} = -1.5 \\ \dfrac{65-\mu}{\sigma} = 1.25 \end{cases}$$

Solving, we have $\mu = 60$ and $\sigma = 4$.

63. C

The variance of the numbers $\{9, 7, 5, 3, 1\}$ is 8.
The numbers in the question can be obtained by the following steps:

(1) Multiply each number by $b$.

(2) Add $a$ to each number.

Required variance is $8b^2$.

64. A

I. ✓.

II. ✗.
Take $x_1 = 1, x_2 = 2, x_3 = 3, \ldots, x_9 = 9$ and $x_{10} = 1000$.
We have $n_1 = 5.5$ and $n_2 = 6$.

III. ✗.
Take $x_1 = 1, x_2 = 2, x_3 = 3, \ldots, x_{10} = 10$.
We have $v_1 = 8.25$ and $v_2 = 7.5$.

65. A

The new set of data is obtained by multiplying 2 to each number of the original set of data.

I. ✓.

II. ✓.

III. ✗.
We have $v_2 = 2^2 v_1 = 4v_1$.

66. C

The new set of numbers are obtained through the following steps:

- Insert the mean $m_1$.
- Multiply each number by 2.
- Subtract 3 from each number.

I. ✓.

II. ✗.
We have $r_2 = 2r_1$.

III. ✓.

The variance of the set of data is less than $v_1$ after the first step.

The variance is multiplied by 4 after the second and third step.

Thus, we have $v_2 < 4v_1$.

67. D

Let $\mu$ and $\sigma$ be the mean and the standard deviation of the test scores respectively.

$$\begin{cases} \dfrac{90-\mu}{\sigma} = 6 \\ \dfrac{36-\mu}{\sigma} = -3 \end{cases}$$

Solving, we have $\mu = 54$ and $\sigma = 6$.

$$\begin{aligned} s &= \frac{57-54}{6} \\ &= 0.5 \end{aligned}$$

68. B

I. ✓.

The means of both distribution are 10.

II. ✗.

The modes of both distribution are 10.

III. ✓.

Let $\sigma_M$ and $\sigma_N$ be the standard deviation of distributions $M$ and $N$ respectively.

We have $\sigma_M > \sigma_N$.

Note that $\dfrac{a-10}{\sigma_M} < \dfrac{a-10}{\sigma_N}$.

The standard score of $a$ in $M$ is smaller.

69. D

The new group of numbers is obtained through the following steps:

- Multiply each number by 2.
- Subtract $4n$ from each number.

I. ✗.

Take $n = 0$.

The median of two groups are 1 and 2 respectively.

II. ✓.

III. ✓.

The inter-quartile range of two groups are 12 and 24 respectively.

70. A

I. ✓.

Let $m$ be the mean of $\{a, b, c, d, e\}$.

The means of $P$ and $Q$ are $x + m$ and $y + m$ respectively.

The mean of $P$ is greater than the mean of $Q$.

II. ✓.

The ranges of $P$ and $Q$ are both $e - a$.

III. ✗.

The variances of $P$ and $Q$ are equal to the variance of $\{a, b, c, d, e\}$.

**END OF PAPER**