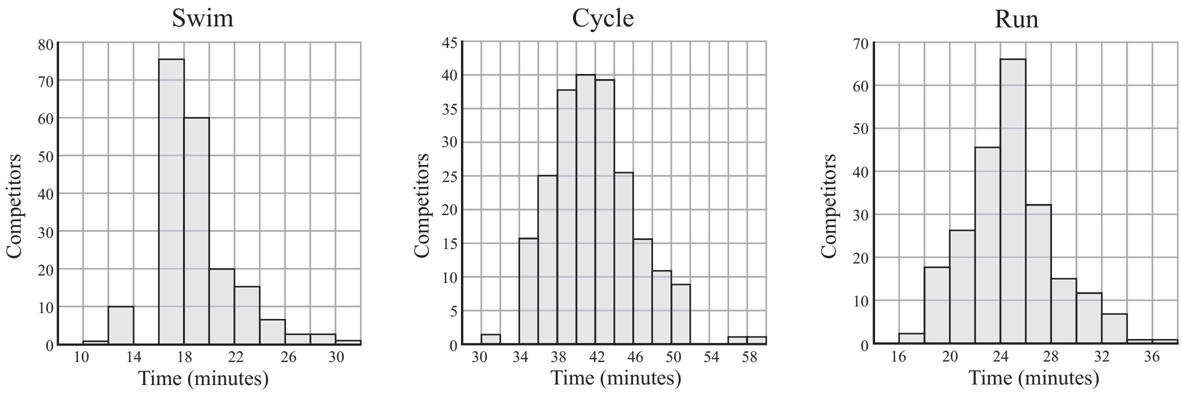
Sample Paper 2014: Paper 2

Question 7 (75 marks)

Question 7 (a)

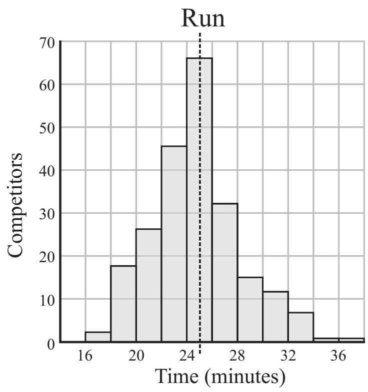
(i)

	Swim	*Cycle*	*Run*
Mean	18.329	41.927	**?**
Median	17.900	41.306	**?**
Mode	#N/A	#N/A	#N/A
Standard Deviation	**?**	4.553	3.409
Sample Variance	10.017	20.729	11.622
Skewness	1.094	0.717	0.463
Range	19.226	27.282	20.870
Minimum	**11.350**	**31.566**	**16.466**
Maximum	**30.576**	**58.847**	**37.336**
Count	224	224	224



You can match the histograms to the events by looking at the maximum and minimum times to complete each event.

(ii) The median is a line on the histogram that bisects its area. The area to the left of it is equal to the area to the right of it. Using your eye this appears to lie along the class interval of 24–26 minutes.
mean ≈ median ≈ 25 minutes



(iii) Swim: Sample Variance $s = 10.017$

$$s = \sigma^2$$

$$\sigma = \sqrt{s} = \sqrt{10.017} = 3.16 \text{ minutes}$$

(iv) There was probably no discrete modal result as all times were different or there were lots of the same times. Therefore, there is no modal time. There is a modal class alright but no modal time.

Question 7 (b)

Cycle vs. Swim: Moderate positive correlation
Run vs. Swim: Moderately strong positive correlation
Run vs. Cycle: Strong positive correlation

Question 7 (c)

Run/Swim: $y = 0.53x + 15.2$
Brian: $x = 17.6$ mins
$y = 0.53(17.6) + 15.2 = 24.528$ mins

Run/Cycle: $y = 0.58x + 0.71$
Brian: $x = 35.7$ mins
$y = 0.58(35.7) + 0.71 = 21.416$ mins

Take the average of the 2 run times: $\dfrac{24.528 + 21.416}{2} = 22.972$ mins

The mean finishing time for the overall event was 88·1 minutes and the standard deviation was 10·3 minutes.

Question 7 (d)

> In any normal distribution with mean μ and standard deviation σ.
> **1**. 68·26% of the data falls within 1σ of the mean μ.
> **2**. 95·46% of the data falls within 2σ of the mean μ.
> **3**. 99·74% of the data falls within 3σ of the mean μ.

$\mu = 88\cdot 1$ mins, $\sigma = 10.3$ mins

$\mu - 2\sigma = 88\cdot 1 - 2(10\cdot 3) = 67\cdot 5$ mins

$\mu + 2\sigma = 88\cdot 1 + 2(10\cdot 3) = 108\cdot 7$ mins

"95% of the athletes took between **67·5** and **108·7** minutes to complete the race."

Question 7 (e)

$$z = \frac{100 - 88.1}{10.3} = 1.155$$

$P(x < 100) = P(z < 1.155) = 0.877$

Number of athletes $= 224 \times 0.877 \approx 196$

> **Formulae and Tables Book**
> **Statistics and Probability: Probability distribution** (standarding formula) [page 34]
> $$\bar{z} = \frac{\bar{x} - \mu}{\bar{\sigma}}$$
> n = Number in the sample
> σ = standard deviation of the sample

Question 7 (f)

Let p = Probabilty of completing the race in less than 100 minutes = $p(0.877)$
Let q = Probabilty of completing the race in more than 100 minutes = $q(1 - 0.877) = q(0.123)$

This is the order in which she interviews the athletes:

Fixed

$q \quad p \quad p \quad p \quad \boxed{p} \quad q$

No. of permutations $= \dfrac{5!}{4!} = 5$

$P = (0.123)^2 \times (0.877)^4 \times 5 = 0.0447$

> **Bernoulli Trials**
> $p = P(\text{Success})$, $q = P(\text{Failure})$
> $P(r \text{ successes}) = {}^nC_r p^r q^{n-r}$

The probability that the second person she interviews will be the sixth person she approaches is about 4·5%.