



GRADE 12 EXAMINATION  
NOVEMBER 2015

**ADVANCED PROGRAMME MATHEMATICS  
ELECTIVE MODULE: STATISTICS**

**MARKING GUIDELINES**

Time: 1 hour

100 marks

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These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

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**STATISTICS**

**QUESTION 1**

$$1.1 \quad \frac{\binom{7}{4}\binom{3}{0}}{\binom{10}{4}} = \frac{1}{6} \quad (7)$$

$$1.2 \quad (a) \quad P(x \geq 1) = 1 - P(\text{none}) \\ = 1 - \binom{10}{0} (0,99)^{10} (0,01)^0 \\ = 0,0956 \quad (6)$$

$$(b) \quad P(x \geq 2) = 1 - P(0 \text{ or } 1) \\ = 1 - \left( \binom{20}{0} (0,99)^{20} (0,01)^0 + \binom{20}{1} (0,99)^{19} (0,01)^1 \right) \\ = 0,0169 \quad (7)$$

(c) The second procedure is less likely to reject the consignment. (1)  
**[21]**

**QUESTION 2**

$$2.1 \quad \mu = 5 + 4 + 10 + 15 = 34 \quad (2)$$

$$2.2 \quad P(x > 40) = P\left(z > \frac{40 - 34}{6,205}\right) \\ = P(z > 0,97) \\ = 0,5 - 0,3340 \\ = 0,166 \quad (8)$$

$$2.3 \quad + 2,33 = \frac{x - 34}{6,205} \\ x = 48,5 \text{ minutes} \\ \therefore 48,5 \text{ minutes before 07h33 is 06h44} \quad (8)$$

**[18]**

**QUESTION 3**

3.1 (a)  $54 = 0,09\bar{x} - 90$   
 $\bar{x} = 1600 \text{ mm}$  (2)

(b)  $y = 0,09 (1500) - 90$   
 $= 45 \text{ kg}$  (2)

(c) A strong linear correlation would be expected due to the fact that we know that as height increases so weight must increase relatively proportionately. (2)

3.2 (a)  $\int_0^3 \frac{k}{9}x(3-x) dx = 1$   
 $\frac{kx^2}{6} - \frac{kx^3}{27} \Big|_0^3 = 1$   
 $\frac{9k}{6} - k = 1$   
 $9k - 6k = 6$   
 $3k = 6$   
 $k = 2$  (8)

(b)  $P(x > 1) = \int_1^3 \frac{2}{9}x(3-x) dx$   
 $= \frac{20}{27}$  (4)

**[18]**

**QUESTION 4**

4.1  $H_0: \mu = 20$   
 $H_1: \mu \neq 20$

Rejection Region:  
Reject  $H_0$  if  $|z| > 1,96$

Test Statistic:  
$$z = \frac{20,05 - 20}{\frac{0,2}{\sqrt{40}}} = 1,58$$

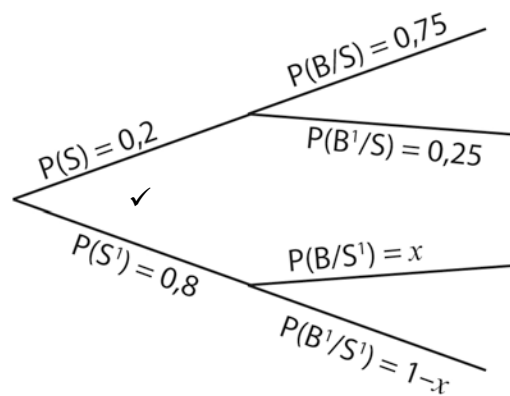
Conclusion:  
Since  $z < 1,96$ , we fail to reject  $H_0$  at the 5% level of significance and suggest insufficient evidence to support the claim, hence the machines should not be altered. (10)

4.2 (a)  $\bar{x} = 63$  (2)

(b)  $z \times \frac{\sigma}{\sqrt{n}} = 3$   
 $\frac{2,17\sigma}{\sqrt{50}} = 3$   
 $\sigma = 9,7757$  (7)  
**[19]**

**QUESTION 5**

5.1 (a)



$P(B) = (0,2)(0,75) + 0,8x$   
 $0,5 = 0,15 + 0,8x$   
 $0,35 = 0,8x$   
 $x = 0,4375$  (8)

$$\begin{aligned} \text{(b)} \quad P(S/B) &= \frac{P(S \cap B)}{P(B)} \\ &= \frac{(0,2)(0,75)}{0,5} \\ &= 0,3 \end{aligned} \qquad (3)$$

$$5.2 \quad \text{(a)} \quad {}^{17}P_{11} = 4,94 \times 10^{11} \quad \text{OR} \quad 17 \times 16 \times 15 \times 14 \times 13 \times \dots \times 7 \qquad (2)$$

$$\text{(b)} \quad {}^{12}P_6 \times 5! = 79\,833\,600 \quad \text{OR} \quad 5! \times 12 \times 11 \times 10 \times 9 \times 8 \times 7 \qquad (5)$$

$$\text{(c)} \quad \binom{3}{2} \binom{7}{1} = 21 \qquad (6)$$

**[24]**

**Total: 100 marks**