

**UNIVERSITY OF KENT**

**DIVISION OF COMPUTING, ENGINEERING  
AND MATHEMATICAL SCIENCES**

**LEVEL 4 EXAMINATION**

**Foundations of Computing I**

**Monday, 15 May 2023 : 14.00 - 16.00 (2 hours)**

<b>Paper Instructions</b>
The paper contains FOUR questions. Answer THREE questions.
An approved calculator is permitted.
<b>Answer each question in a separate book.</b>
<b>Students are not permitted to remove this question paper from the examination venue</b>

1. (a) Perform the following Octal calculations without changing base.  
Show your working.

(i)  $47 + 63$

(ii)  $47 \times 63$

[10 marks]

- (b) Solve the following:

(i)  $4x + 7 = 51$

(ii) 
$$\begin{cases} 5x - 7y = -3 \\ 2x + 3y = 22 \end{cases}$$

(iii)  $5x^2 + 3x - 6 = 0$

[10 marks]

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
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2. (a) (i) Find the mean and standard deviation for the following set of data:

[4 marks]

x	10	20	30	40	50
f	2	3	3	1	1

- (ii) A further 20 items with a mean of 25 and standard deviation of 10 are added to the initial set of data. Find the combined mean and standard deviation for all 30 items.

[9 marks]

- (b) Widgets are packed in boxes ready for shipping, with 10 widgets per full box. The mean weight of an individual widget is 12g and the standard deviation is 3g. The corresponding figures for the boxes are  $\mu = 15g$  and  $\sigma = 4g$ . Find the combined mean and standard deviation of the weight of a full box of widgets.

[7 marks]

$$\bar{x} = \frac{\sum fx}{\sum f}$$
$$\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

3. (a) Find the sum to infinity for the series  $27 + 9 + 3 + \dots$

[4 marks]

- (b) Find the values of  $a$ ,  $b$ ,  $c$ ,  $d$  and  $e$  such that

$$(3 + 2x)^a = b + 216x + cx^2 + 96x^d + ex^4$$

[8 marks]

- (c) Draw a Hasse diagram to represent the relation “exactly divides” on the natural numbers from 1 to 16 inclusive.

[8 marks]

$S_{\infty} = \frac{a}{1 - r}$
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4. A series is defined by  $S_n = \sum_{r=1}^n (2^r + r)$

(a) Find the first 3 terms of the series [6 marks]

(b) Use the method of induction to prove that

$$S_n = 2(2^n - 1) + \frac{n}{2}(n + 1) \quad [14 \text{ marks}]$$