UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

Foundation Year
2008/09

COMPUTING

IS50001A (FY02)
Foundation Mathematics for Computing

EXAMINATION

Duration: 3 hours

You should answer all the questions on this paper. There are ten questions in total. All questions are worth 10 marks. The marks for each part of a question are indicated at the end of the part in [.] brackets.

No calculators should be used.

THIS PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

1. **This question is about numbers, fractions, ratios and the binary and hexidecimal number systems.**

   (a) Convert the following into decimals. [3]

      i. $\frac{1}{3}$

      ii. $\frac{1}{8}$

   (b) Write the following as fractions in their simplest form. [2]

      i. 0.238

      ii. 0.0125

   (c) Write how much Asif, Beth and Charlie get if they share £5000 in the following rations [2]

      i. 1:4:5

      ii. 1:10:89

   (d) Calculate the following and show your working in binary. [3]

      i. $1011_2 + 1110_2$

      ii. $11011_2 - 1110_2$

      iii. $1001_2 * 110_2$

2. **This question is about sets and logic.**

Complete truth tables for the following an hence decide whether each of the logical formula is a contingency, tautology or a contradiction.

(a)

$$(P \wedge \neg Q) \vee Q$$

[4]

$$(\neg P \Rightarrow \neg Q) \Rightarrow (\neg P \Rightarrow R)$$

[6]

3. **This question is about sets and Venn diagrams.**

The sets A, B and C are defined as follows.

$$A = \{1, 3, 5, 7, 9\}$$

$$B = \{0, 1, 2, 4, 6, 8\}$$

$$C = \{2, 4, 5, 6, 7\}$$

$$\epsilon = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

(a) Calculate the following. [5]

i. $A \cup B$

ii. $A \cup (B \cap C)$

iii. $(A \cup B) \cap C$

iv. $\overline{A} \cup B$

v. $\overline{A \cap C}$

(b) Shade the following regions on a Venn diagram for general sets P, Q and R. [5]

i. $P \cap Q$

ii. $\overline{P \cap Q}$

iii. $\overline{(P \cup Q) \cap \overline{R}}$

4. **This question is about series.**

Consider the following series.

(i) $x_k = 3 + 4k$

(ii) $x_k = 3 - 5k$

(iii) $x_k = k + \frac{1}{k}$

(iv) $x_k = \frac{2}{3^k}$

(a) Write down x_1 and x_2 for series (i). [2]

(b) Decide which of the 4 expressions are aritmetic, geometric or neither. [4]

(c) Find the sum of the first 6 terms of series (ii). [2]

(d) Find the sum of the infinite series (iv). [2]

5. **This question is about linear, simultaneous and quadratic equations.**

(a) Solve the following equations. [3]

$4(3-x)=12$

$\frac{4x+2}{2}+8x=0$

(b) Solve the following quadratic equations by factorisation. [4]

$x^2+x-2=0$

$2x^2+3x-2=0$

(c) Solve the following simultaneous equations. [3]

$x-2y=-11, 7x+y=-32$

6. **This question is about functions.**

Consider the following functions.

$$f(x) = x^3$$

$$g(x) = \frac{1}{x+1}$$

$$h(x) = 3x - 1$$

(a) Evaluate the following. [3]

i. $f(1)$

ii. $f(h(3))$

iii. $f(g(h(\frac{1}{3})))$

(b) Write an expression for $f(2x)$ and $f(x+1)$. [2]

(c) Find $g^{-1}(x)$. [2]

(d) Write an expression for $f(g(h(x)))$. [3]

7. **This question is about plotting graphs.**

(a) Plot graphs for the following equations $y = x + 4$ and $y = 2 - x$ and state the point where they meet. [4]

(b) Plot $y = x^2 - 1$ and hence solve $y = 0$. [3]

(c) Sketch the following graphs. [3]

$y = x^3$

$y = -x^3$

$y = (-x)^3$

8. **This question is about trigonometry.**

(a) Sketch a right angled triangle with base 3, height 4 and hypoteneuse 5. [2]

(b) Make x the angle between the sides of length 3 and 5. Then calculate the following. [3]

$cos\ x$

$sin\ x$

$tan\ x$

(c) In which quadrant (1,2,3 or 4) does the angle x lie for the following situations? [2]
$sin\ x > 0$ and $cos\ x > 0$
$sin\ x < 0$ and $cos\ x > 0$
$sin\ x < 0$ and $cos\ x < 0$

(d) Solve $sin\ 2x = 0$ for $0 \leq x < 360$. [3]

9. **This question is about matrices.**

(a) Evaluate the following. [2]

$$\begin{pmatrix} 3 & 2 & 1 \\ 0 & 0 & 1 \\ 1 & 3 & 6 \end{pmatrix} + \begin{pmatrix} 0 & 1 & 2 \\ 0 & 0 & 1 \\ 1 & 2 & 3 \end{pmatrix}$$

(b) Evaluate the following. [2]

$$\begin{pmatrix} 2 & 1 \\ 3 & 6 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$$

(c) Write down the identity 4 by 4 matrix. [2]

(d) Find the inverse of the following matrix. [2]

$$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$

(e) Prove that the following matrix has no inverse. [2]

$$\begin{pmatrix} a & b \\ a^2 & ab \end{pmatrix}$$

10. **This Question is about Probability.**

(a) This is about tossing 2 coins. [3]

i. What is the probability of obtaining exactly two heads?

ii. What is the probability of obtaining exactly one head?

iii. What is the probability of obtaining exactly no heads?

(b) If I tossed a coin 5 times what is the probability of getting 5 heads in a row? [2]

(c) A biased die with 6 sides has the following probabilities [5]

$P(1) = 0.1$

$P(2) = 0.15$

$P(3) = 0.1$

$P(4) = 0.2$

$P(5) = 0.2$

$P(6) =$ *unknown*

i. What is P(6)?

ii. What is the probability of getting an odd number?

iii. If the die is thrown twice, what is the probability of getting a total score of 3?

iv. If the die is thrown twice, what is the most likely total score?

v. If the die is thrown twice, what is the probability of the total score being an even number?