UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

Foundation Year Examination 2010

Computing

IS50002A (FY02)   Foundation Mathematics

Duration: 3 hours

Date and time:

There are ten questions in this paper. You should attempt all questions. Full marks will be awarded for complete answers ten questions. Each question carries 10 marks. The marks for each part of a question are indicated at the end of the part in [.] brackets.

There are 100 marks available on this paper.

Electronic calculators may not be used

THIS PAPER MUST NOT BE REMOVED
FROM THE EXAMINATION ROOM

Question 1   This question is about numbers, fractions and the binary and hexadecimal number systems.

(a) Convert the following:

    i. The fraction $\frac{4}{9}$ into a decimal

    ii. The binary number 1011 into a decimal number

    iii. The decimal 0.24 into a fraction in its lowest terms

    iv. The decimal number 29 into a binary number

[4]

(b) Calculate the following, writing your answers as fractions in their simplest form.

    i. $\frac{2}{3} + \frac{1}{4}$

    ii. $\frac{4}{9} \div \frac{8}{3}$

[2]

(c) Calculate the following and show all your working in binary.

    i. $1101_2 + 1011_2$

    ii. $10101_2 - 1011_2$ [2]

(d) Convert the following numbers into hexadecimal.

    i. 301 in base ten

    ii. 1010101 in base two

[2]

Question 2   This question is about ratios, standard form, decimal places and significant figures

(a) A blend of fruit juice contains orange, mango and apple juice in the ratio 3 : 2 : 5. Calculate how many ml of each type of juice there are in a 500ml carton.

[2]

(b) Write down the following numbers correct to 2 decimal places.

    i. 0.3449

    ii. 0.3454

    iii. 0.395

[3]

(c) Write down the following numbers correct to 3 significant figures.

    i. 252.525

    ii. 40.064

    iii. 2344.2344

[3]

(d) Express the following numbers in standard form.

    i. 98766

    ii. 0.000987

[2]

Question 3   This question is about sets, logic and Venn diagrams.

(a) Complete truth tables for the following and hence decide whether it is a contingency, tautology or a contradiction.

$$(\neg p \vee q) \Rightarrow q$$

[3]

(b) The sets A, B and C are subsets of a universal set U as follows.

$$U = \{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o\}$$

$$A = \{l, i, m, e\}$$

$$B = \{l, e, m, o, n\}$$

$$C = \{f, i, g\}$$

List the following sets:

   i. $A \cap B$

  ii. $B \cup C$

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

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

[5]

(c) Shade the following regions on separate Venn diagrams for general sets P and Q.

  i. $P \cup \overline{Q}$

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

[2]

Question 4   **This question is about Series.**

Consider the following series.

i. $\displaystyle\sum_{k=1}^{20}(2k+1)$

ii. $\displaystyle\sum_{k=1}^{10}(3-2k)$

iii. $\displaystyle\sum_{k=1}^{20}3^k$

iv. $\displaystyle\sum_{k=1}^{4}\frac{k+1}{2k}$

(a) Write down the first three terms of each series. [4]

(b) Decide which of the 4 series are arithmetic, geometric or neither. [2]

(c) Find the sum of series i) using the appropriate formula. [2]

(d) Find the sum of series iv), leaving your answer as a fraction. [2]

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

(a) Solve the following equations.

  i. $6 = 3(1+2x)$

  ii. $\frac{3x-2}{4} + 2x = 5$

[2]

(b) Solve the following quadratic equations.

  i. $x^2 - 3x - 10 = 0$ by factorisation.

  ii. $x^2 + 6x + 9 = 0$ by factorisation.

  iii. $2x^2 - 3x - 6 = 0$, using the formula.

[5]

(c) Solve the following simultaneous equations.

$$x - 2y = -5, \qquad 7x + y = 10$$

[3]

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

Consider the following functions.

$f(x) = x^2; \quad g(x) = \frac{1}{x}$ where $x \neq 0; \quad h(x) = x + 2.$

(a) Evaluate the following.

   i. $f(-2)$
   ii. $g(h(2))$
   iii. $f(h(g(\frac{1}{2})))$

[3]

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

(c) Find $h^{-1}(x)$ and $h^{-1}(8)$. [2]

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

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

(a) Consider the following equations.

$$y = x + 6, \quad y = -2x + 3$$

Plot the straight lines represented by these equations on graph paper for $-8 \leq x \leq 8$. Find the point of intersection of these lines [4]

(b) Plot the graph of $y = x^2 - 4$ for $-3 \leq x \leq 3$ and hence solve $y = 0$. [3]

(c) Sketch the following graphs, showing where they cut the axes.

   i. $y = 2^x$
   ii. $y = -2^x$
   iii. $y = 2^x - 1$

[3]

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

(a) Sketch a right angled triangle with base 6 and height 8 units. The hypoteneuse of this triangle is h units.

    i. Find h.

    ii. Let A be the angle between the base and the hypoteneuse. Find the following, leaving your answer as a fraction.

$$\cos A; \quad \sin A; \quad \tan A.$$

[4]

(b)   i. Given that $\sin 30° = 0.5$ and $\sin 60° \approx 0.866$, use graph paper to sketch the graph of y=$\sin x$ for $-360° \leq x \leq 360°$, showing where it cuts the x-axis.

    ii. Use your graph to find any other possible angles whose sine is equal to 0.5 which lie between -360 and 360 degrees.

[6]

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

(a) Evaluate the following.

    i.

$$3 \begin{pmatrix} 2 & 1 \\ -4 & 5 \end{pmatrix} - \begin{pmatrix} 2 & 0 \\ -4 & 5 \end{pmatrix}$$

    ii.

$$\begin{pmatrix} 2 & 3 \\ 1 & 5 \end{pmatrix} \begin{pmatrix} 3 & 2 \\ 1 & 0 \end{pmatrix}$$

.

[4]

(b)   i. Write down the 2 by 2 identity matrix, **I**.

    ii. Find the inverse of the following matrix **M**.

$$\begin{pmatrix} 3 & -2 \\ -5 & 4 \end{pmatrix}$$

    iii. What is the result of pre-multiplying this inverse by the identity matrix **I**?

    iv. What is the result of pre-multiplying this inverse by the original matrix **M**?   [6]

Question 10   This question is about probability.

(a) This is about throwing 2 fair dice.

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

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

    iii. What is the probability of obtaining a total on both dice of 11?

           [3]

(b) I throw a fair coin 3 times.

    i. What is the probability I get three heads?

    ii. What is the probability I get more heads than tails?

           [2]

(c) A bag of sweets contains 9 sweets of which 5 are green and 4 are yellow. I pick out two sweets at random, one after the other without replacement.

    i. Draw a tree diagram to show the possible outcomes of this process.

    ii. Find the probability that both sweets are yellow.

    iii. Find the probability that both sweet are different colours.

           [5]