GMIT
GALWAY-MAYO INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA NA GAILLIMHE-MAIGH EO

GMIT EXAMINATIONS

SESSION: SUMMER 2010

PROGRAMME: **BSc. IN SOFTWARE DEVELOPMENT**
BSc. IN BUSINESS COMPUTING AND DIGITAL MEDIA

YEAR: STAGE 1
Time:

MODULE: **ESSENTIAL MATHEMATICS for COMPUTING 1 & 2**

EXTERNAL EXAMINERS:

INTERNAL EXAMINERS: **MS. M. BROWNE**

TIME ALLOWED: 3 HOURS

INSTRUCTIONS TO CANDIDATES:

Answer FIVE QUESTIONS

Attachments:	**Yes**	☐	**No**	☐	
Special Requirements:	**Yes**	☐	**No**	☐	**NEW LOG TABLES, GRAPH PAPER**
Calculators permitted:	**Yes**	☐	**No**	☐	

Q.1 (a) Solve the following equations for x:

(i) $\dfrac{4x+1}{7} + \dfrac{2x-1}{3} = 6$

(ii) $\dfrac{4}{x-3} - 2 = \dfrac{x}{2x+1}$ (correct to two decimal places)

(6 marks)

(b) Make the symbol indicated in the [ ] the subject of the formula shown.

(i) $B = \dfrac{5(c-d)}{a} - 9$ [d]

(ii) $p = \sqrt{\dfrac{qs(t+m)}{mt-2}}$ [t]

(8 marks)

(c) Solve the following simultaneous equations to obtain both solutions for x and y:

$$3x - y = 1$$
$$x^2 - 5xy + 2y^2 = 4$$

(6 marks)

Q.2 (a) Evaluate **X** in each of the following equations. Give answer rounded to 2 decimal places if it is not a whole number .

(i) $\text{Log}_5\left(\dfrac{1}{25}\right) = X$ (ii) $\text{Log}_{27} X = \dfrac{4}{3}$ (iii) $\text{Log}_5(3X+4) = 2$

(iv) $\text{Ln}(5X - 7) = 2.9$ (v) $\text{Log}_{10}(3 - 2x) = 0.24$

(10 marks)

(b) Solve the following exponential equations, correct to two decimal places.

(i) $10^{4X+1} = 1234$ (ii) $4e^{3x-2} = 398$ (iii) $(7.9)^{2x-5} = 803$

(7 marks)

(c) Solve the logarithmic equation for x

$$\text{Log}(4x - 3) + \text{Log}(x + 1) = 2\text{Log}(x + 3)$$

(3 marks)

Q.3 (a) Given $\mathbf{B} = \begin{pmatrix} 1 & 0 & 3 \\ 4 & 1 & -3 \\ 2 & -1 & 1 \end{pmatrix}$

Calculate (i) $\mathbf{B}^2$ and $\mathbf{B}^3$

(ii) $\mathbf{B} \cdot \mathbf{B}^T$ (7 marks)

(b) If A = $\begin{pmatrix} 3 & 2 & -1 \\ 2 & 3 & 1 \\ 5 & -2 & 3 \end{pmatrix}$ find (i) $|\mathbf{A}|$ (ii) Adj A (iii) A^{-1}

(9 marks)

(c) Use (b) above to solve the following system of equations for x, y and z.

$$\begin{aligned} 3x + 2y - z &= 22 \\ 2x + 3y + z &= 13 \\ 5x - 2y + 3z &= 12 \end{aligned}$$ (4 marks)

Q.4 (a) Convert the following numbers to decimal by first writing them in expanded form:

(i) 11101001.111_2 (ii) 35672.74_8 (iii) F5D4 C_{16}

(7 marks)

(b) Convert the following decimal numbers to the base indicated:

(i) 143.78125 to binary

(ii) 10287.46875 to octal

(iii) 43193 to hexadecimal

(8 marks)

(c) (i) Set up the binary octal conversion table and convert the decimal number 979 to binary via octal

(ii) Set up the binary hexadecimal conversion table and convert the following binary numbers to hexadecimal:

1010100000111011_2 100111011000000100_2 (5 marks)

Q.5 An analysis of access time, in milliseconds, to a computer disc system was made during the running of a particular computer programme, which utilised disc handling facilities. The results of the 80 access times were as follows:

Access time(millisec)	30 - < 40	40 - < 50	50 - < 60	60 - < 70	70 -< 80	80 - < 90
No. of programmers	14	17	25	11	9	4

(i) Draw and comment on the shape of the histogram for this data. (2 marks)

(ii) Plot the ogive (cumulative frequency curve) and determine the percentage of access times exceeding 65 milliseconds. (3 marks)

(iii) Calculate the mean and median access times for this programme, showing calculations. (5 marks)

(iv) Compute the standard deviation and coefficient of variation, correct to two decimal places. (7 marks)

(v) Use the ogive in (i) above to estimate the percentage of the data that lies within one standard deviation of the mean. (3 marks)

Q.6 (a) From an inventory of 50 laptops manufactured by a company 13 have defective batteries installed. A Galway dealer was supplied with ten of these laptops. Calculate the probability, correct to four decimal places that:

(i) none of the laptops have defective batteries (4 marks)

(ii) at least three have defective batteries (4 marks)

And

(iii) find the mean and standard deviation of the random variable which represents the number of laptops, delivered to the Galway dealer, that have defective batteries. (2 marks)

(b) The following data relates to the number of computer jobs per day and the central processing unit(CPU) time required:

Number of jobs	2	5	3	8	6
CPU time	9	19	10	28	16

$\sum xy = 463$

(i) Plot a scatter diagram and comment on the type of relationship that exists between the variables. (2 marks)

(ii) Use your calculator to find the equation of the least squares regression line of CPU time on the number of jobs, correct to two decimal places. Interpret the regression slope coefficient in the context of this problem. (5 marks)

(iii) Use the regression line to predict the average CPU time needed if 4 jobs are planned on a given day. (1 mark)

(iv) Calculate the coefficient of determination and interpret your answer. (2 marks)

Q.7 (a) A computer company tenders for two independent contracts. It is estimated, based on previous tenders, that the probability of winning contract A is .58 and the corresponding figure for contract B is .45. Find, stating the law when appropriate, the probability that the company will be successful in winning

(i) both contracts
(ii) at least one contracts
(iii) only one contract
(iv) no contract

(6 marks)

(b) Explain the difference between a *contradiction* and a *tautology*. Given the three propositions p, q and r, verify whether the following propositions are contradictions, tautologies or neither by constructing **truth tables**:

(i) $(\mathbf{p \wedge q}) \wedge \neg \mathbf{q}$

(ii) $(\mathbf{p \wedge q}) \rightarrow (\mathbf{p \vee q})$

(iii) $\neg (\mathbf{p \wedge q}) \vee (\neg \mathbf{q \vee r})$

(9 marks)

(c) Draw up truth tables for the following logic gates, having two inputs A and B:

(i) OR gate (ii) NOR gate (iii) NAND gate

(5 marks)