THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF SOFTWARE ENGINEERING
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

ECZ3161 - MATHEMATICS FOR COMPUTING
FINAL EXAMINATION - 2010/ 11 **CLOSE BOOK**

Date: November 28, 2010 **Time: 0930 – 1230 hrs**

Instructions

1. Answer any **five** out of eight questions.
2. Show all steps clearly.
3. **Programmable** calculators are **not** allowed.

Q1

(a) Use Demorgan's theorem to simplify the following expressions:

i) $\overline{(\bar{a}+b)(a+\bar{b})}$ ii) $\overline{(a+b+c)abc}$

(b) Use Truth tables to show the followings:

i) $(a+b)(\bar{a}+\bar{b}) = a\bar{b}+\bar{a}b$ ii) $\overline{x+\bar{y}+z} = \bar{x}y\bar{z}$

(c) The variables A, B, C & D are four Boolean inputs (1 for TRUE and 0 for FALSE) of a truth table. The Z is the output variable which is given by:

$$Z = \begin{cases} 1 & ; \text{at least three inputs are TRUE} \\ 0 & ; \text{otherwise} \end{cases}$$

i) Setup the Truth Table.

ii) Draw the Karnaugh map for the above Truth table.

iii) Then find the solution and simplify using the K map.

Q2 Consider the following 3×3 matrices.

$$A = \begin{pmatrix} 2 & 1 & 3 \\ -2 & 0 & 1 \\ 3 & 1 & 2 \end{pmatrix} \qquad B = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 4 & 9 \end{pmatrix}$$

(a) Find,

i) $A+B^T$ ii) $B+A^T$

(b) Check whether the given A & B matrices satisfy the equation:

$$(A+B)^T = A^T + B^T$$

(c) Find the 3×3 matrix Z, which satisfies the equation:

$$AB^T + Z = I \quad \text{(the unit matrix)}$$

Q3 Consider the 3×3 matrix, A, where the elements (a_{ij}) of the matrix is given by

$$a_{ij}=\begin{cases} j-i & ;\ for\ i<j \\ i\times j & ;\ for\ i=j \\ i-j & ;\ for\ i>j \end{cases}$$

(a) Find the matrix A.

(b) Find the inverse of A using Gaussian elimination method.

Q4

(a) Given that $Tan\alpha=1/2$, α in quadrant III, and $Sin\beta=3/4$, β in quadrant II, Find

i) $Sin3\alpha$ ii) $Cos(\alpha-\beta)$ iii) $Tan(\alpha+\beta)$

Give exact answers and show all your work.

(b) Sketch the graph $y=\cos\left(x-\frac{\pi}{3}\right)$ in the period of $-2\pi\le x\le 2\pi$.

(c) Answer the following problems:

i) A man stands at the edge of a river directly opposite a tree on the other side of the river. He walks 15m along (on a straight line) the edge of the river. Then he measures the angle between his line of sight to the tree and his line of travel. He finds it to be 60°. What is the width of the river?

ii) From a point on a level road to the base of a mountain, the angle of elevation to the top of the mountain is 30°. From a second point on the road 1Km closer to the mountain, the angle of elevation is 60°. Find the height of the mountain in meters.

Q5

(a) Answer the followings, show all your work.

i) If $m.Tan\theta-1=0$ and $0^{\circ}<\theta<90^{\circ}$, determine the value of $Cot\theta-Co\sec\theta$ in terms of m.

ii) If $Sin\theta=p$ and $2Cos\theta=4p$, where $\theta<90^{\circ}$, determine the numerical value of p.

(b) Prove the followings.

i) $\cos(A+B)+\cos(A-B)=2\cos A\cos B$

ii) $\dfrac{2\sin^2 x}{2\tan x-\sin 2x}=\cot x$

iii) $\cos 75^{\circ}+\cos 15^{\circ}=\sqrt{\dfrac{3}{2}}$

(c) Find the general solution of the following equation for the range $0^{\circ}<\theta<360^{\circ}$.

$$1+4\sin^2\theta-5\sin\theta+\cos 2\theta=0$$

Q6

(a) Find the following limits:

i) $\lim_{x\to 0}\frac{Tan2x}{6x}$ ii) $\lim_{x\to\sqrt{3}}\frac{(x-\sqrt{x})^3}{x^2-3}$ iii) $\lim_{x\to 0}\frac{(x+1)^2+1}{x(x+1)}$

(b) The function $f(x)=e^x$ for the range of $x=0.0$ to 1.0.

i) Write the complete Difference table for the function $f(x)$. Use $h=0.2$ as the intervals. The values should be in four decimal places.

ii) Select $x_0=0.4$ and find the value of $f(0.43)$ by using Newton's forward formula.

Q7

(a) Find the first derivatives of the following from first principles. Show all steps.

i) $1/x^2$ ii) $Cos\,x$

(b) Find $\frac{dy}{dx}$ as a function of x for

i) $y=(1-2x^3)^{1/2}$ ii) $y=(x^2+1)Cos^3x$

(c) If $y=\frac{x}{Cosx}$ show that

$$y^2-\left(\frac{dy}{dx}\right)\frac{1}{Cosx}+\left(\frac{dy}{dx}\right)^2=\left(x+\frac{Sin2x}{2}\right)\frac{x}{Cos^4x}$$

Q8

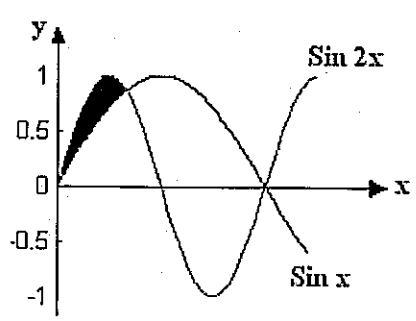
(a) Evaluate the following.

i) $\int(Cos\,2x-Sin\,3x)\,dx$ ii) $\int 5\,Cos(4-3x)\,dx$

(b) Find the exact value of the following.

i) $\int_0^2\frac{1}{x^2+4}dx$ ii) $\int_0^2\frac{1}{\sqrt{3-4x^2}}dx$

(c) Consider the following figure with two curves.



i) Write an equation to find the shaded area using definite integral method.

ii) Hence, find the shaded area of the figure.

- End.