Uva Wellassa University, Sri Lanka
End Semester Examination – February / March 2012
SCT 201-2 Mathematics II

Time: Two (02) hours

Total Three (03) questions.
Answer all questions.
Calculators are allowed.

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01. a.) State elementary row operations for Matrices.

b.) An automobile company uses three types of steel S_1, S_2 and S_3 for producing three types of cars C_1, C_2 and C_3. The steel requirement (in tons) for each type of car is given below.

		Cars		
		C_1	C_2	C_3
	S_1	2	3	4
Steel	S_2	1	1	2
	S_3	3	2	1

Determine the number of cars of each type which can be produced using 29, 13 and 16 tons of steel of the three types respectively.

(Hint: You may construct a linear system of equations for unknowns x_1, x_2 *and* x_3, which denote the number of cars that can be produced of each type)

02. a.) Convert the following linear program into the standard form

$$\begin{aligned} &Min \quad z = -2x_1 + 3x_2 \\ &s.t. \quad x_1 - 3x_2 \le 3 \\ &\quad -x_1 + 2x_2 \ge 2 \\ &x_1 \ urs \ , \ x_2 \ge 0 \end{aligned}$$

b.) Dorian Auto manufactures luxury cars and trucks. The company believes that its most likely customers are high-income women and men. To reach these groups, Dorian Auto has embarked on an ambitious TV advertising campaign and has decided to purchase 1-minute commercial spots on two types of programs: comedy shows and football games. Each comedy commercial is seen by 7 million high-income women and 2 million high-income men. Each football commercial is seen by 2 million high-income women and 12 million high-income men. A 1-minute comedy ad costs $ 50,000 and a 1-minute football ad costs $ 100,000. Dorian would like the commercials to be seen by at least 28 million high-income women and 24 million high-income men. Use linear programming to determine how Dorian Auto can meet its advertising requirements at minimum cost.

03. a.) i.) The Bernoulli differential equation is of the form

$$\frac{dy}{dx} + P(x)\,y = Q(x)\,y^n$$

For $n \ge 2$, show that the substitution $u = y^{1-n}$ transforms the Bernoulli equation into the linear equation

$$\frac{du}{dx} + (1-n)P(x)\,u = (1-n)\,Q(x)$$

ii.) Use the method of part (i.) to solve the differential equation $\frac{dy}{dx} + \frac{2}{x}y = \frac{y^3}{x^2}$.

b.) Solve the Initial Value Problem.

$$u'' - 8u' + 17u = 0 \quad ; \ u(0) = -4 \ \ and \ \ u'(0) = -1$$