Mansoura University		Production Engineering Dept. Total Marks: 100 Marks	Faculty of Engineering
Course Title: Programming Application in Production Eng.			Course Code: 5215
Date: Wed. 15 Jan 2014		Allowed time: 3 hr.	No. of Pages: (02)
Remarks: (Answer the following questions... assume any missing data)			

Question-1 (20 points)

a. Write a function to perform the following operations on input matrices **a, b** and return the result for each operation:

a. $a * b^2 + 2 * a^{-1}$

b. $|a^3|^2 + |a * b|^2$

b. Write a program to compute a table of the function $f(x) = x \sin\left[\frac{\pi(1+20x)}{2}\right]$ over the (closed) interval [−1, 1] using increments in x of 0.2. Get your program to draw the graph of **f (x)**

Question-2 (20 points)

a. Write a script which will input a number in binary code (e.g. 1100—no blanks between the digits) and write its decimal value (12 in this case). Hint: Input the number as a string, and make use of the fact that the string is an array.

b. **Debug** the code which is supposed to plot the polynomial $x^4 - 1$ between $x = -2$ and $x = 2$

```
x = -2:0.1:2;
c = [1 0 0 -1];
y = polyval(c,x)
plot(y,x)
```

Question-3 (30 points)

a. Chemical reaction rates are proportional to a rate constant k that changes with temperature according to the Arrhenius equation $k = k_0 e^{-Q/RT}$. For a certain reaction, $= 8000\ cal/mol$, $R = 1.987\ cal/mol\ K$, $k_0 = 1200\ min^{-1}$. Find the values of k for temperatures from **100 *K*** to **500 *K***, in 50° increments. Create a table of your results. Develop a **MATLAB** solution (**Script** file)

b. Plot projectile trajectories using equations for ideal projectile motion:

$$y(t) = y_0 - \frac{1}{2} g\, t^2 + (v_0 sin(\theta_0))\, t$$

$$x(t) = x_0 + (v_0 \cos(\theta_0))\, t$$

Where y(t) is the vertical distance and x(t) is the horizontal distance traveled by the projectile in meters, g is the acceleration due to Earth's gravity = 9.8 m/s2 and t is time in seconds. Let us assume that the initial velocity of the projectile $v_0 = 50.75$ m/s and the projectile's launching angle $\theta_0 = \frac{5\pi}{12}$ radians. The initial vertical and horizontal positions of the projectile are given by $y_0 = 0$ m and $x_0 = 0$ m. Let us now plot y vs. t and y vs. x in two separate graphs with the vector: t = 0: 0.1: 10 representing time in seconds.

Question-4 (30 points)

a. A calculator company produces a scientific calculator and a graphing calculator. Long-term projections indicate an expected demand of at least 100 scientific and 80 graphing calculators each day. Because of limitations on production capacity, no more than 200 scientific and 170 graphing calculators can be made daily. To satisfy a shipping contract, a total of at least 200 calculators much be shipped each day.

If each scientific calculator sold results in a $2 loss, but each graphing calculator produces a $5 profit, how many of each type should be made daily to maximize net profits? Solve using MATLAB

b. In order to ensure optimal health (and thus accurate test results), a lab technician needs to feed the rabbits a daily diet containing a minimum of 24 grams (g) of fat, 36 g of carbohydrates, and 4 g of protein. But the rabbits should be fed no more than five ounces of food a day.

Rather than order rabbit food that is custom-blended, it is cheaper to order Food X and Food Y, and blend them for an optimal mix. Food X contains 8 g of fat, 12 g of carbohydrates, and 2 g of protein per ounce, and costs $0.20 per ounce. Food Y contains 12 g of fat, 12 g of carbohydrates, and 1 g of protein per ounce, at a cost of $0.30 per ounce.

What is the optimal blend? Solve it using MATLAB.

Best wishes

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