Previous Engineering 201: (Exam 1-Spring 2010)

Part 1:

*Suppose you want to buy a new, energy efficient, cooking pan. What type of pan would you choose?

a. A pan with a high thermal conductivity

b. A pan with a high thermal expansion coefficient

c. A pan with a high density

d. A pan with a high heat capacity coefficient

e. None of the above

*When a conflict between team members occurs, which member of the team will most likely try to gather team members together in an attempt to find a solution to the conflict?

a. The solver

b. The gatherer

c. The team worker

d. The motivator

e. None of the above

*The protection of "original works authorship", literary, dramatic, musical, artistic, and all types of intellectual works is provided by a:

a. Trademark

b. Patent

c. Service Mark

d. Copyright

e. None of the above

*The bulk modulus of compressibility of a fluid represents:

     a. A measure to determine the change in the volume of a fluid occurring when the temperature of the fluid is changed

     b. A measure of how compressible a fluid is

     c. The pressure exerted by the vapor during evaporation and condensation cycles

     d. A measure of how easily the given fluid can flow

     e. None of the above

*If the heat capacity of material A is higher than the heat capacity of material B, then:

     a. Material A is better than B at storing thermal energy

     b. Material A is better than B in transferring heat from high-temperature region to a low-temperature region

     c. Material B is better than A at storing thermal energy

     d. Material B is better than A in transferring heat from high-temperature region to a low-temperature region

     e. None of the above

*The Basic steps involved in the solution problems are in order:

     a. Assumptions, problem definition, analysis, verification of results

     b. Problem definition, assumptions, analysis, verification of results

     c. Problem definition, analysis, assumptions, verification of results

     d. Problem definition, assumptions, verification of results, analysis

     e. None of the above

*The equivalent of Pa in terms of basic dimensions is:

    a. $kg.m^{-1}.s^{2}$

    b. $kg.m^{-1}.s^{-2}$

    c. $kg.m.s^{-2}$

    d. $kg.m^{2}.s^{-2}$

    e. None of the above

*Which of the following is not considered as a major air pollutant according to EPA standards?

    a. Nitrogen Dioxide (NO_2)

    b. Carbon monoxide (CO)

    c. Ozone (O_2)

    d. Sulfur monoxide (SO)

    e. None of the above

*The Chinese international basketball player Yao Ming is 7 ft and 5 in tall. How tall is he on the SI system of units? (1 ft = 0.3048 m ; 1 ft = 12 in)

    a. 2.26 m

    b. 2.16 m

    c. 2.46 m

    d. 2.36 m

    e. None of the above

*Convert 2.479 hours into minutes, and report the answer rounded to the proper number of significant digits

    a. 148.7 min

    b. 148.74 min

c. 149 min

d. 147 min

e. None of the above

*Choose the incorrect statement:

a. Engineers shall not request, propose, or accept a commission under circumstances in which their judgment may be compromised

b. Engineers shall not be influenced in their professional duties by conflicting interests

c. Since engineers study all the fundamentals of engineering during their university studies, they are allowed to perform services outside their area of expertise

d. Engineers shall not affix their signatures to any plans or documents dealing with subjects in which they lack competence

e. Engineers shall not reveal facts, data, or information without the prior consent of their client or employer except as authorized or requires by the law or by the Code of Ethics for Engineers

*Following the engineering procedure for recording results, give the result of the following operation:
A = 1725.463 + 189.2 + 16.73 and B = 589.62/1.246

a. A = 1931.39 and B = 473.2103

b. A = 1931.393 and B = 473.21027

c. A = 1931 and B = 473.2

d. A = 1931.4 and B = 473.21

e. None of the above

*How much rice is in the jug? (The scale is in millimeter)

a. 300 +/- 50 ml

b. 300 +/- 25 ml

c. 250 +/- 50 ml

d. 275 +/- 25 ml

e. None of the above

Part 2:

*Complete the "Acronymania" crossword puzzle displayed below. The answer in each **puzzle clue** is the acronym of a **well-known organization** that part of the engineering enterprise:

.Across: 1. All products sold in Europe must comply with the standards

2. Many mechanical engineers belong to this professional society

. Down: 3. Sets the standards for maximum level of contaminants in air in U.S.

4. Publishes standards dealing with material methods

* List in order the steps of the engineering design process:

1. Finding the need for a product or a service

2. Defining and understanding the problem

3. Research and preparation

4. Conceptualization

5. Synthesis

6. Evaluating

7. Optimization

8. Presentation

*List the three sources of outdoor air contaminants and give an example of each:

1 .Stationary sources: Power plants

2. Mobile sources: Trucks

3. Natural sources: Volcano eruptions

*What are MCLG and MCL? Explain briefly the difference between them:

.MCLG: Maximum contaminants level goal

.MCL: Maximum contaminants level

*.MCLG: Max level contaminants that **still make water healthy and not harmful for health***

.MCL: Max level of substances in water legalized and allowed

*List four major branches of civil engineering:

1. Transportation

2. Environmental

3. Structural

4. Geothermal

*List four major benefits you get from joining a professional engineering society:

      1. Published engineering journals

      2. Networking mechanism

      3. Conferences, seminars and meetings

      4. Sharing of standards and codes

Part 3:

- Optimization problem:

  *Bryant's Pizza, Inc. is a producer of frozen pizza products. The company makes a net income of $2.00 for each regular pizza and $3.00 for each deluxe pizza product. The firm currently has 300 pounds of dough mix and 100 pounds of topping mix. Each regular pizza uses 2 pound of dough mix and 8 ounces (16 ounces = 1 pound) of topping mix. Each deluxe pizza uses 2 pound of dough mix and 1 pound of topping mix. Based on the past demand per week, Bryant can sell at least 100 regular pizzas and at least 50 deluxe pizzas. How many of each type of pizza should be made weekly to maximize net profits?

        a. Identify the design variables
        b. Write the optimization function
        c. Write necessary constraints
        d. Draw the optimization figure
        e. Solve the problem numerically

a. Suppose: X_1: Number of regular pizza, and X_2: Number of deluxe pizza
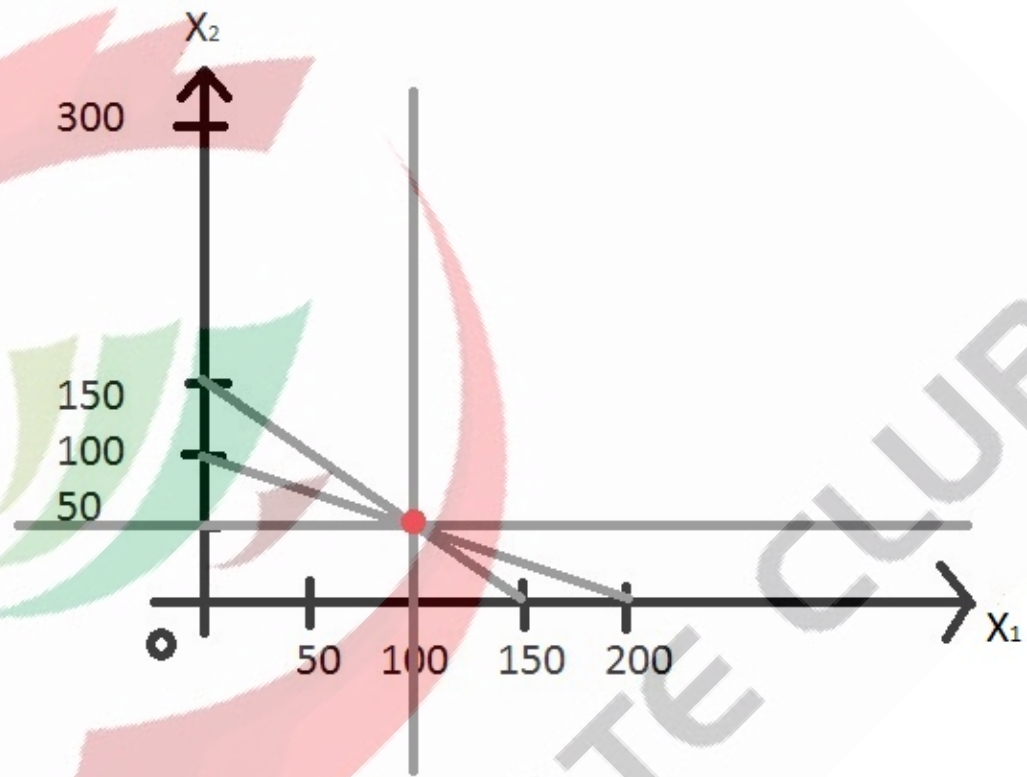
b. Maximize: $Z = 2X_1 + 3X_2$

c. $X1 >= 0$; $X2 >= 0$

   $2X1 + 2 X2 <= 300$

   $0.5X1 + X2 <= 100$

   $X1 >= 100$ and $X2 >= 50$

d.

e.

X1,X2	Z
(150,0)	300
(200,0)	400
(0,100)	300
(0,150)	450
(100,50)	350
(100,0)	200
(0,50)	150

f.   *So the Bryant's Pizza should do 150 regular pizzas and 50 deluxe pizzas weekly, because this point on the graph has the highest Z that could be acceptable comparing with the table and the graph and the equations. It is the highest Z in the feasible region.*

Part 4:

*An equation to compute the average pressure at various height regimes is:

$$P = P_b \cdot \left[T_b \Big/ \left(T_b + L_b \cdot (h - h_b) \right) \right]^{g_0 \cdot M / R^* \cdot L_b}$$

Where:

P = Pressure (Pa)

P_b = Static pressure (Pascals, Pa)

T_b = Standard temperature (Kelvins, K)

L_b = Standard temperature lapse rate

h = Height above sea level (meters, m)

h_b = Height at bottom of layer b (meters, e.g., h_1 = 11,000 m)

R^* = Universal gas constant: 8.31432 J/(K.mol)

g_0 = Standard gravity (9.80665 m/s^2)

M = Molar mass of Earth's air (0.0289644 kg/mol)

Find the unit of the standard temperature lapse rate (in fundamental units), **L_b**.

$$Pa = Pa \cdot \left[K \Big/ (K + L_b (m - m)) \right]^{\left((m2 \cdot Kg/mol) / (K.mol + L_b) \right)}$$

→ $$1 = \left[K \Big/ (K + L_b (m - m)) \right]^{\left((m2 \cdot Kg/mol) / (K.mol + L_b) \right)}$$

→ $$1 = \left[K \Big/ (K + L_b (m - m)) \right]^{(1/Lb)}$$

→ $$1 = \left[K^{Lb-1} \Big/ (K + L_b.m)^{Lb-1} \right]$$

→ $$K^{Lb-1} = (K + L_b.m)^{Lb-1}$$

→ $$K = (K + L_b.m)$$

→ $$L_b = (K - K) / m$$

→ $$\mathbf{L_b = K/m}$$

Part 5:

*Suppose that you have decided to purchase a new laptop. You visited several stores and you found three laptops that meet your requirements. Develop a decision table comparing the three laptops A, B and C, and then specify which is best to purchase. The three laptop characteristics are given in the table.

In your analysis use the following scale for R: 1   2   3

Low   Medium   High

Consider that the speed is low if less than 2.1 GHz and high if more than 2.6 GHz, the memory is low if less than 1 GB and high if more than 3 GB, the cost is low if less than $900 and high if more than $2000, the HDD capacity is low if less than 150 GB and high if more than 300 GB, the weight is low if less than 3 Kg and high if more than 5 Kg, and finally the number of USB ports is low if less than 2 ports and high if more than 3 ports.

Laptop		A	B	C
	Speed	2.1 GHz	2.4 GHz	2 GHz
	Memory (RAM)	3 GB	4 GB	2 GB
	Cost	$1,200	$1,600	$1,000
specifications	HDD capacity	160 GB	320 GB	160 GB
	Weight	5.2 Kg	3.3 Kg	4.1 Kg
	# of USB ports	4 ports	4 ports	2ports

	Importance level	A		B		C	
		R	IxR	R	IxR	R	IxR
(+)Speed	4	2	8	2	8	1	4
(+) Memory (RAM)	4	2	8	3	12	2	8
(-)Cost	5	2	10	2	10	2	10
(+)HDD capacity	4	2	8	3	12	2	8
(-)Weight	3	3	9	2	6	2	6
(+) # of USB ports	2	3	6	3	6	2	4
NET SCORE			11		**22**		8

→ *So the best laptop to purchase that fits best the requirements suggested is the laptop B because it has the highest Net Score between the three laptops.*