

ชื่อ-สกุล.....รหัส.....

มหาวิทยาลัยสงขลานครินทร์
คณะวิศวกรรมศาสตร์

ข้อสอบกลางภาค: ภาคการศึกษาที่ 1

ปีการศึกษา: 2556

วันที่สอบ: 30 กรกฎาคม 2556

เวลา: 9.00-12.00

วิชา: 230 -466 การประยุกต์คอมพิวเตอร์สำหรับวิศวกรเคมี

ห้องสอบ: COM 1

ทูลิตในการสอบ โทษขันต่ำ คือ ปรับดกในรายวิชาที่ทูลิต และพักการเรียน 1 ภาคการศึกษา

- อนุญาตให้นำเอกสารทุกชนิดเข้าห้องสอบได้
- อนุญาตให้นำแผ่นข้อมูลเข้าห้องสอบได้
- ไมอนุญาตให้นำเครื่องคำนวณใดๆ เข้าห้องสอบ
- ห้ามหยิบยืมเอกสารและแผ่นข้อมูล
- เขียนชื่อ และรหัสทุกหน้า (ข้อสอบทั้งหมดมี 8 หน้า รวมปก)

ข้อ	คะแนนเต็ม	คะแนนที่ได้
1	35	
2	35	
3	35	
4	35	
รวม	140	

รศ. ดร. ลือพงศ์ แก้วศรีจันทร์

ผู้ออกข้อสอบ

ชื่อ-สกุล.....รหัส.....

1. (35 points) Calculate the terminal velocity of coal $\rho_p = 1,200 \text{ kg/m}^3$, $D_p = 3.3 \text{ millimeter}$ falling in one of the water at 27°C in a centrifuge separator where the acceleration (a) is $30,000g$. Additional information and data are as followed.

a. viscosity and density water at 27°C ($\mu = 0.86 \times 10^{-3} \text{ kg/(m s)}$,

$$\rho = 997 \text{ kg/m}^3)$$

b. assuming that the coal particles are spherical, a force balance on a particle yields

$$v_t = \sqrt{\frac{4a(\rho_p - \rho)D_p}{3C_D\rho}}$$

Where v_t [m/s], g [m/s^2], ρ_p [kg/m^3], D_p [m] and C_D [dimensionless coefficient], g [9.81 m/s^2]: $C_D = 24/Re$ for $Re < 0.1$, $C_D = (24/Re)(1 + 0.14Re^{0.7})$ for $0.1 \leq Re \leq 1000$, $C_D = 0.44$ for $1,000 \leq Re \leq 35,000$ and $C_D = 0.19 - 8.0 \times 10^4/Re$ for $35,000 < Re$

Fill in density, viscosity, acceleration in SI unit and also give symbols that you are going to use in the program:

	Symbol	Value	Unit
density of fluid			
density of coal			
viscosity			
acceleration			

Use Polymath to calculate the velocity by filling in the following window of $f(v)$ and CD

Solve with:

safenewt

Comments

Add NLE

Add EE

Remove

Edit



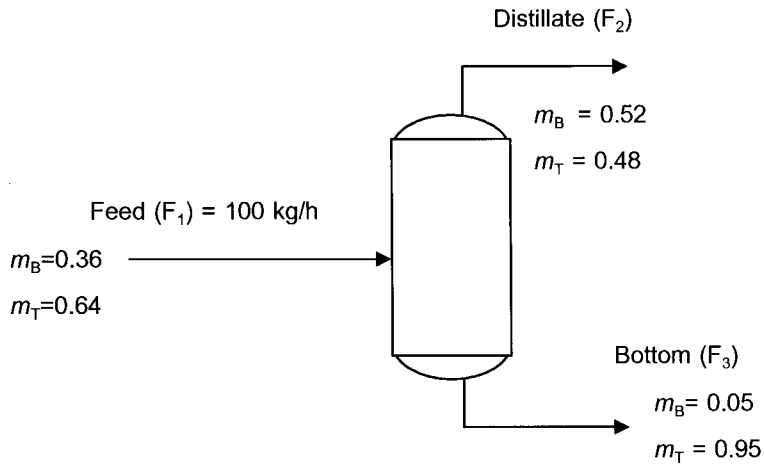
Implicit equations / explicit equations	
$f(v_t) =$	
$CD =$	

Fill in the following results

	value	Unit		value	Unit		value	Unit
Re			C_D			v_t		

ชื่อ-สกุล.....รหัส.....

2. (35 points) The feed to a distillation column contains 36 % benzene by weight, the remainder being toluene. The overhead distillate is to contain 52 % benzene by weight, while the bottoms are to contain 5 % benzene by weight.



Direction 1: Fill in the following window for (a) Number of linear equations and (b) x_1, x_2, x_3, \dots and beta for each row of the linear equation.

Number of linear equations

Matrix of Coefficients and beta vector of constants

	x1	x2	x3	x4	x5	beta
1						
2						
3						
4						
5						

Show the results after calculate in linear equation solver above

$F_2 =$ kg/h

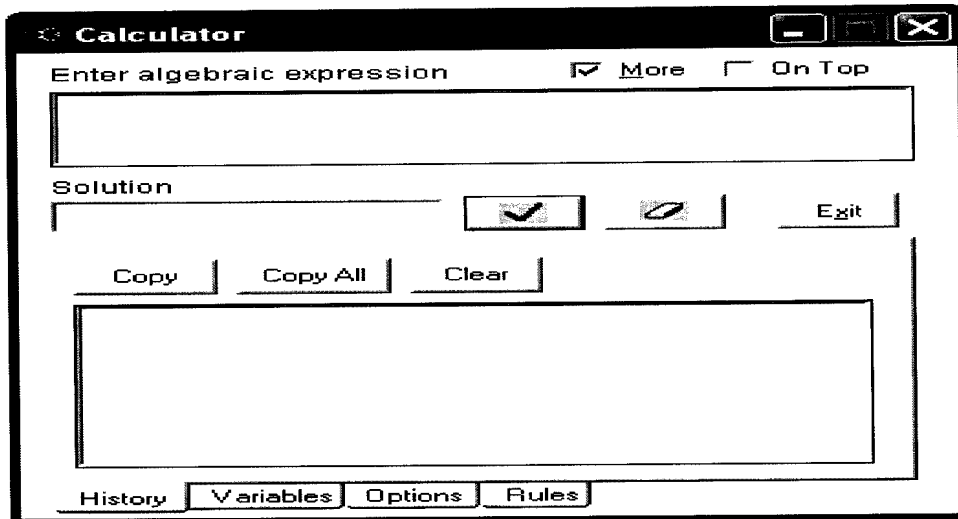
$F_3 =$ kg/h

ชื่อ-สกุล.....รหัส.....

(Reserved for problem # 2)

Direction 2: Calculate mass flow rate in unit of kg/h of benzene (n_B) and toluene (n_T) in F_3 by calculator

$n_B =$ kg/h $n_T =$ kg/h



Answer the questions:

(a) The percentage of benzene fed containing in the distillate:

Ans.....%

(b) The percentage of the total which leaves as distillate:

Ans.....%

ชื่อ-สกุล.....รหัส.....

3. (35 points) Use method of multiple linear regression to determine parameters (a , b, c, and d) for the vapor pressure (P_{vap}) data of propane

$$\frac{P_{vap}}{P_c} = \frac{a(1-T/T_c) + b(1-T/T_c)^{1.5} + c(1-T/T_c)^3 + d(1-T/T_c)^6}{T/T_c}$$

Where: P_c = critical pressure of pure substance = 42 atm (for propane)

T_c = absolute critical temperature of pure substance = 370 K (for propane)

T = absolute temperature

	Temp	Pressure		Temp	Pressure
No	(F)	(psia)	No	(F)	(psia)
1	-70	7.37	11	30	66.3
2	-60	9.72	12	40	78
3	-50	12.6	13	50	91.8
4	-40	16.2	14	60	107.1
5	-30	20.3	15	70	124
6	-20	25.4	16	80	142.8
7	-10	31.4	17	90	164
8	0	38.2	18	100	187
9	10	46	19	110	213
10	20	55.5	20	120	240

Direction 1: Show the window of the multiple linear regressions by selecting independent variable(s) and dependent variable (express names and formulas of each column; also show the values of row 02, 04 and 06) Note: You should declare the values by using 2 decimal only!

R020 : C001 T_F X ✓											
	T_F	P_psia	C03	C04	C05	C06	C07	C08	C09	C10	C11
02	-60	9.72									
03											
04	-40	16.2									
05											
06	-20	25.4									
07											

- name
- formula
- C03 =
- C04 =
- C05 =
- C06 =
- C07 =
- C08 =
- C09 =
- C10 =
- C11 =

Regression | Analysis | Graph |

Report Store Model Graph Residuals

Linear & Polynomial Multiple linear Nonlinear

Dependent Variable

Independent Variables

Through origin

ชื่อ-สกุล.....รหัส.....

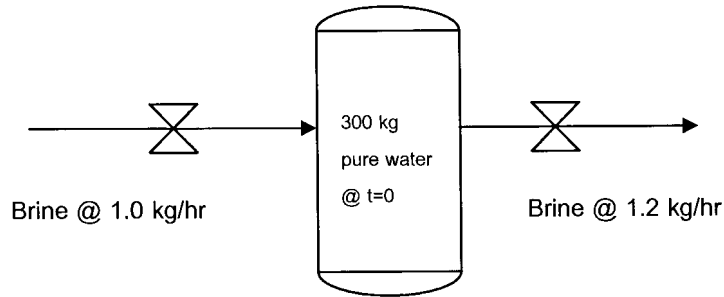
(Reserved for problem # 3)

Direction 2: Show your results of a , b , c , d and R^2 after regression

	value
a	
b	
c	
d	
R^2 (not the Gas constant)	

ชื่อ-สกุล.....รหัส.....

4. (35 points) A well-mixed tank cylinder of initially 300 kg of pure water needs to mix with brine solution. At time zero a brine solution (30 % salt by weight) is being filled with an inlet flow of 1 kg/hr at the same time the outlet flow of the brine solution from the cylinder is 1.2 kg/h. (1) What is the total weight and concentration of the brine in the tank after the opening of the valves for 18 hours? (2) At what time the weight per cent brine in the cylinder reach 5%?



Note: At $t=0$, there is no brine in the tank,
Two valves opened at time zero

(1) Fill the blanks of Initial value, Final value and put Differential equations and explicit equations.

Indep Var Initial Value
 Solve with Final Value

Table Graph Report Comments

	Differential equations / explicit equations	Initial value	Comments
1			total mass in cylinder
2			Total salt in cylinder
3			percent of salt in cylinder
4			
5			
6			
7			
8			
9			

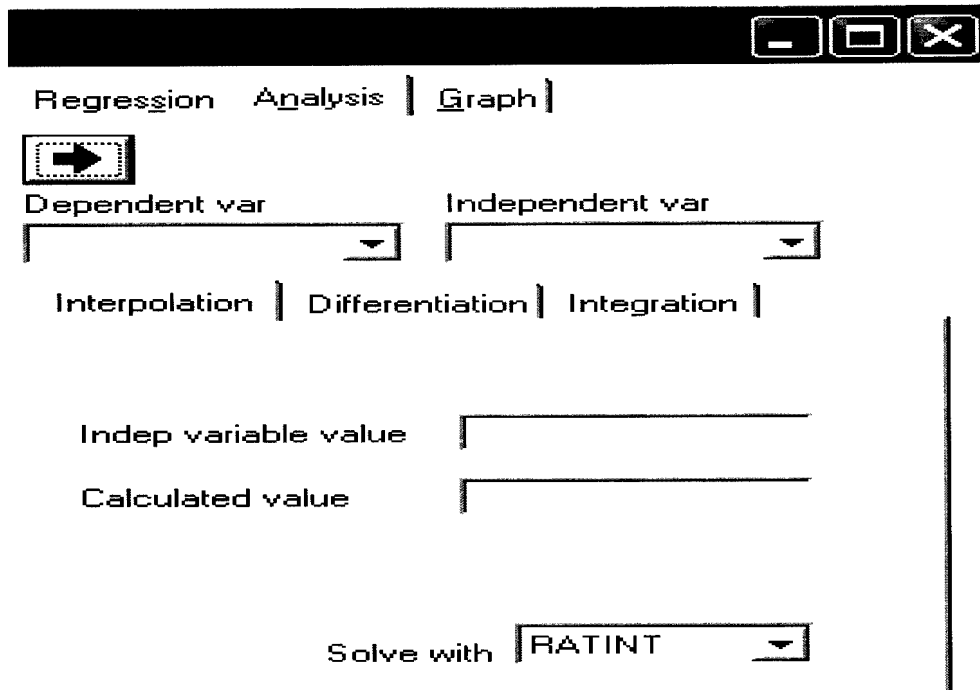
What is the total weight and concentration of the brine in the tank after the opening of the valves for 18 hours?

Ans.....


ชื่อ-สกุล.....รหัส.....

(Reserved for problem # 4)

(2) Calculate the time that the weight per cent brine in the tank is 5% by mean of the following window.



Regression Analysis | Graph



Dependent var Independent var

Interpolation | Differentiation | Integration

Indep variable value

Calculated value

Solve with