BIRZEIT UNIVERSITY
FACULTY OF COMMERCE AND ECONOMICS
BUSINESS DEPARTMENT

INSTRUCTOR: RAMI B. KASHOU'
FIRST HOUR EXAM
OPERATIONS MANAGEMENT
BUSA 3321

40/50

FIRST SEMESTER 2014/2015
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Section #: 11:00

1. (9 points) The Abco Company manufactures electrical assemblies. The current process uses 10 workers and produces 200 units per hour. You are considering changing the process with new assembly methods that increase output to 300 units per hour, but will require 14 workers. Particulars are as follows:

	CURRENT PROCESS	NEW PROCESS
OUTPUT (UNITS / HOUR)	200	300
NUMBER OF WORKERS	10	14
MATERIAL COST / HOUR	$120	$150

Workers are paid at a rate of $10 per hour, and overhead is charged at 140% (or 1.4 times) labor costs. Finished switches sell for $20 / unit.

a. Calculate the multifactor productivity for the current process (show your answers in $ output/$ spent on production)
b. Calculate the multifactor productivity for the new process (show your answers in $ output/$ spent on production)
c. Determine if the new process should be implemented

a) multi. factor productivity = $\frac{\text{Output}}{\text{Inputs}}$

$= \frac{200 * 20}{10 * 10 + 1.4 * 100 + 120}$

$= \frac{4000}{360}$

$= 16.67 \$/\$ = \cancel{16.67}$ 11.11

b) multi. factor productivity = $\frac{\text{Output}}{\text{Inputs}}$

$= \frac{300 * 20}{14 * 10 + 150 + \boxed{1.4} * 140}$

$= \frac{6000}{} = 12.35$

← D

2. (3 points) The Burdell Company wants to develop a sales forecast for a fast-selling new product line it has introduced, in order to help plan future production. The following information has been gathered by the Marketing Department. The past weekly average is 4,200 and the trend has been 250 additional units per week. This week's demand was 4,600 units. Using trend adjusted exponential smoothing, calculate the forecasted sales for next week? (Suppose $\alpha = 0.20$ and $\beta = 0.40$.)

Avg. demand	F_t	T_t	$F_t + T_t$
4,200	4,200	250	4460
4600	4,400	230	4530
??	4,544	241.6	4785.6

Exponential smoothing . Trend Adjusted

$$F_t = \alpha(A_{t-1}) + (1-\alpha)(F_{t-1} + T_{t-1})$$

$$T_t = \beta(F_t - F_{t-1}) + (1-\beta)(T_{t-1})$$

1st. week :

$$F_t = 0.20(4200) + 0.8(250 + 4200)$$

$$= 4,480$$

$$T_t = 0.4(200) + 0.6(250)$$

$$= 230$$

$$\Rightarrow F_t + T_t = 4785.6$$

Next week forecast:

$$F_t = 0.2(4600) + 0.8(4,530)$$

$$= 45,44$$

$$T_t = 0.4(144) + 0.6(230)$$

$$= 241.6$$

2

4744

nat is the expected time for activity B?
What is the variance for activity B?
Based on the calculation of estimated times, what is the critical path?
d. What is the estimated time of the critical path?
e. What is the activity variance along the critical path?
f. What is the probability of completion of the project after week 42?

a) expected time for Activity B $= \frac{a + 4m + b}{6}$

$= 9$

b) variance of Activity B $= \left(\frac{b-a}{6}\right)^2$

$= 9$

c) A C F H I J is the critical path

d) Estimated time for the CP = 40 weeks

e) AV along the CP is = ΣV along the CP activities

$= 1 + 1.78 + 0.11 + 0.44 + 1.78 + 0.11$

$= 5.22$

f) $Z = \frac{42 - 40}{\sqrt{5.22}}$

$= 0.88$

before 42 ~~days~~ weeks the probability is = 81.06 %

after 42 weeks the probability of completion = 100 − 81.06

= 18.94 %

2. (6 points) A drive-in restaurant has experienced the following customer loads on the past 8 Friday nights. If their forecast for period seven was 59 customers, then what is their forecast for period number 9 using a smoothing constant of 0.7? $\alpha = 0.7$

Friday	# Customers	Fc
1	49	
2	55	
3	57	
4	59	
5	56	
6	61	
7	62	59
8	63	61.1
9		62

$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$

$F_8 = 59 + 0.7(62 - 59)$

$= 59 + (0.7)(3) \Rightarrow 61.1 \approx 61$ because # of customer

~~$F_9 = 61 + (0.7)(63 - 61.1) \Rightarrow 62.43$~~

$F_9 = 61 + (0.7)(63 - 61) \Rightarrow 62.4 \approx \boxed{62}$

$F_{(9)} = 61 + (0.7)(63 - 61) \Rightarrow 62.4 \approx \boxed{62}$

So Forecast period (9) = 62

(10 points) A large department store has collected the following monthly data on lost sales revenue due to theft and the number of security guard hours on duty (It is believed that thefts depend on guard hours) :

Lost Sales Revenue ($000's) y		Total Security Guard hours x	Lost Sales Revenue ($000's)		Total Security Guard hours
1.0	1000	600	1.8	1800	950
1.4	1400	630	2.1	2100	1300
1.9	1900	1000	2.3	2300	1350
2.0	2000	1200			

xy	x^2
600,000	360,000
882,000	396,900
1900,000	1000,000
2400,000	1440,000
1710,000	902,500
2730,000	1690,000
3105,000	1822,500
13,327,000	7,611,900

(a) Determine the least squares regression equation.

(b) Find the estimated lost sales revenues if the total number of security guard hours is 800.

(a) $y = a + bx$

$b = \dfrac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n\bar{x}^2}$

$\bar{x} = \dfrac{\Sigma x}{n}$

$= 1,004.3$

$\bar{y} = \cancel{1385} \quad \cancel{1385.7} \quad 1.786$

$b = \dfrac{13,327,000 - \cancel{7,611,900}}{}$

$b = \dfrac{13,327,000 - 12,555.7685}{7,611,900 - \cancel{7,060,529.43}}$

$= \dfrac{771,241}{} = 1398 \times 10^{-3}$

Equation

$y = 1.398x - 1402.23$

(b) $y = \cancel{52.951.87}$

Equation $\Rightarrow$

$y = 0.38174 + 1.398 * 10^{-3} x$

(b) when $x = 80$

$y = 81.5$ (in thousand)

Demand ↑ 25%

3. (9 points) Douglas Kosb operates a bakery in Jogfalls, India. Because of its excellent product and excellent location, demand has increased by 25% last year. On far too many occasions, customers have not been able to purchase the bread of their choice. Because of the size of the store, no new ovens can be added. At a staff meeting, one employee suggested ways to load the ovens differently so that more loaves of bread can be baked at one time. This new process will require that the ovens be loaded by hand, requiring additional manpower. This is the only thing to be changed. If the bakery makes 1500 loaves per month with a labor productivity of 2.344 loaves per labor hour. How many workers will Douglas need to add? (each worker works 160 hours per month).

make 1500 Loaves / month → Labor productivity 2.344/H

* ↑ Demand 25% * each worker works 160 H/month

Labor productivity = $\frac{\text{output}}{\text{Labor productivity}}$

$= \frac{1500}{2.344} = \frac{1500}{375.04} = 3.99 \approx 4 \text{ L/H}$

Last year

* ↑ Demand ↑ Increase 25% → 1500 * 1,25 → 1,875 ← new Dema

$\frac{\text{output}}{\text{Labor productivity (Input)}} = \frac{1,875}{160 \text{ H} * 2.344} = 5 \text{ L/H}$

5 worker

One worker

(6 points) Central States Electric Company estimates its demand trend line (in millions of kilowatt hours) to be D=77+0.43Q. Q was equal to 1 in winter 1984. In addition the seasonal indexes were as following winter 0.8, spring 1.1, summer 1.4 and fall 0.7. Forecast energy use for summer 2009.

2008 - 1984 = 24 year * 4

= 96 period * fall 2008

Summer 2009 is the 99th period

D = 77 + 0.43 * 99 (103)

= 119.57

25 years before 100 season

+ 3 seasons

= 103 seasons

Forcasted energy used in summer 2009 = 1.4 * 119.59

= 131.527

18 points) Consider the tasks, durations, and predecessor relationships in the following network. Draw the network and answer the questions that follow.

Activity Description	Immediate Predecessor (s)	a Optimistic (Weeks)	m Most Likely (Weeks)	b Pessimistic (Weeks)	$\frac{a+4m+b}{6}$ t	variance
A	---	4	7	10	7	1
B	A	2	8	20	9	9
C	A	8	12	16	12	1.78
D	B	1	2	3	2	0.11
E	D, C	6	8	22	10	7.11
F	C	2	3	4	3	0.11
G	F	2	2	2	2	0
H	F	6	8	10	8	0.44
I	E, G, H	4	8	12	8	1.78
J	I	1	2	3	2	0.11

4 points) Enrollment in a particular class for the last four semesters has been 120, 126, 110, and 130. Suppose a one-semester moving average was used to forecast enrollment (this is sometimes referred to as a naive forecast). Thus, the forecast for the second semester would be 120, for the third semester it would be 126, and for the last semester it would be 110. What would the MSE be for this situation?

		A − F	Forcast		$(AF)^2$
120	120	0			
126	126	0	120	6	36
110	110	0	126	16	256
130	130	0	110	20	400
					692

MSE = 0

$$MSE = \frac{\Sigma (Actual - Forcast)^2}{N}$$

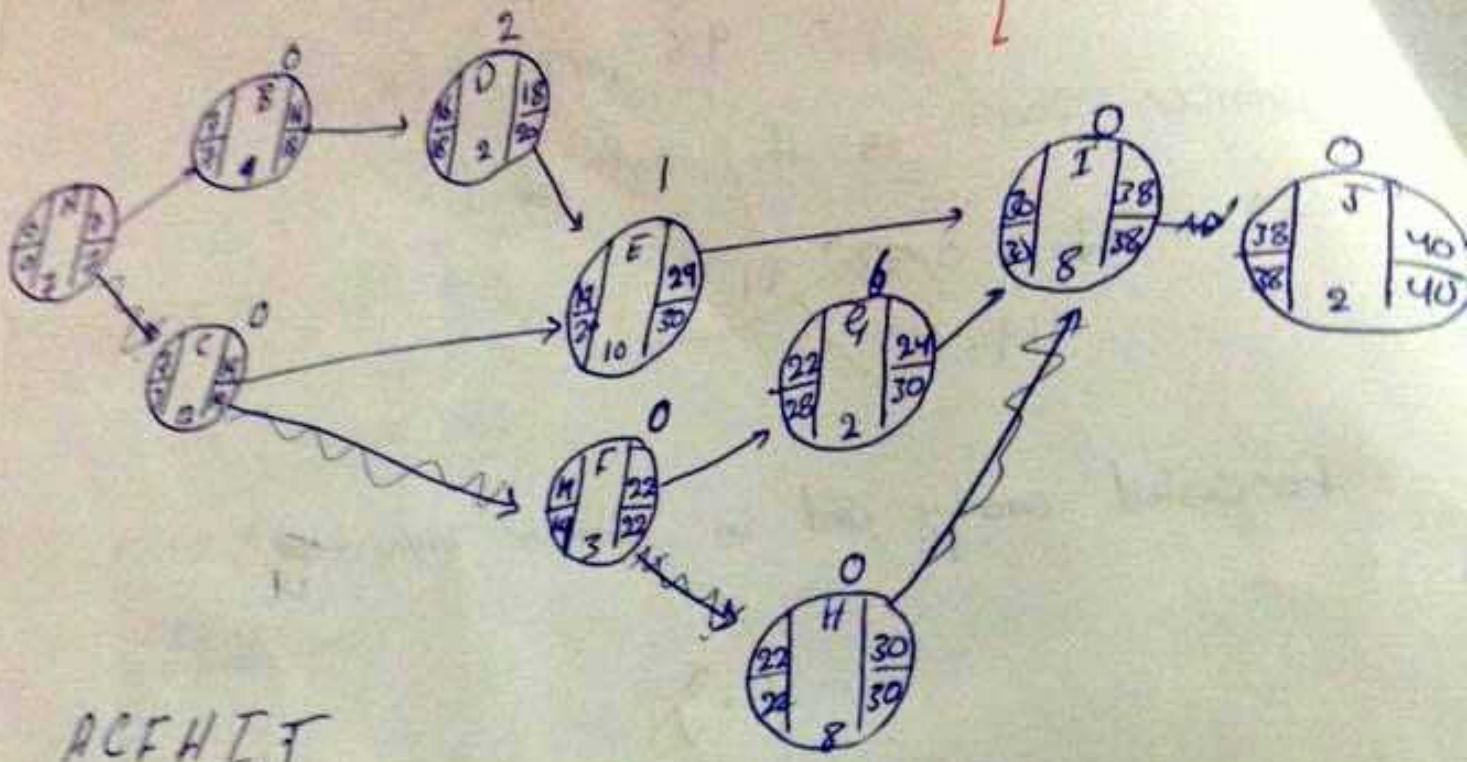
$$= \frac{\Sigma (0+0+0+0)^2}{N}$$

$$= 0$$

$$MSE = \frac{692}{3}$$

$$= 230.67$$

Good Luck



ACFHIJ

d) % Δ in productivity = $\frac{\text{New prod.} - \text{old prod.}}{\text{old prod.}}$

$= \frac{12.35 - 11.11}{11.11} * 100\%$

$= 11.16\%$

$\Longrightarrow$ The new process should be implemented because the new prod. > old prod.