PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Mid-term Examination: Semester 1   Academic Year: 2005
Date: August 1, 05.   Time: 13.30 – 16.30
Subject: 225-344 Work Study and Industrial Plant   Room: R 300

Instructions

- There are 7 questions (19 pages).
- Total score is 105.
- Answer all questions.
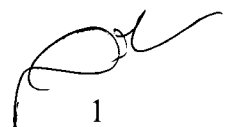- Dictionary, calculators, computers, books and lecture-notes are allowed.

ด้วยเกียรติและศักดิ์ศรี ข้าพเจ้าจะซื่อสัตย์ในการสอบ

ลงชื่อ..

ทุจริตในการสอบโทษขั้นต่ำคือปรับตกในรายวิชาที่ทุจริต และพัก

การเรียน 1 ภาคการศึกษา

1. Why is it necessary to construct process charts from direct observation, as opposed to information obtained from the foreman? (3 points)

2. The following information shows activities of inspecting and making incoming parts at the receiving department of an aircraft factory.

        Lift from truck: placed on inclined plane
        Slid on inclined plane
        Slid to storage and stacked
        Await unpacking
        Lid removed: delivery noted taken out
        Placed on hand truck
        Trucked to reception bench
        Await discharge from truck
        Case discharge from truck
        Cartons taken from case: opened: checked replaced contents
        Case loaded on hand truck
        Delay awaiting transport
        Trucked to inspection bench
        Await inspection
        Inspected
        Await transportation
        Transport to distribution point
        Store

Develop the flow process chart.

(7 points)

FLOW PROCESS CHART

JOB...

....

CHART BEGINS.................................

CHART ENDS...................................

CHARTED BY..................................

DATE...

CHART NO...........SHEET NO. ....OF....

WORK PLACE..................................

OPERATOR ....

CHART TYPE ☐ MAN ☐ MATERIAL
          ☐ EQUIPMENT

SUMMARY

	NUMBER	TIME/DIST
○ OPERATION		
⇨ TRANSPORTATION		
☐ INSPECTION		
D DELAY		
▽ STORAGE		

☐ PRESENT METHOD
☐ PROPOSED METHOD

Dist (m)	Time (Min)	Chart Symbols	Description	Notes
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		TOTAL		

3. From the class assignment, you have already visited a work station to observe their processes. Prepare process chart and flow diagram for the full processes for both:
   1. present method
   2. improved method

(15 points)

FLOW PROCESS CHART

JOB...

CHART BEGINS.............................
CHART ENDS.................................
CHARTED BY................................
DATE...
CHART NO..........SHEET NO. ....OF....
WORK PLACE.................................
OPERATOR ....
CHART TYPE ☐ MAN ☐ MATERIAL
             ☐ EQUIPMENT

SUMMARY

	NUMBER	TIME/DIST
○ OPERATION		
⇨ TRANSPORTATION		
☐ INSPECTION		
☐ DELAY		
▽ STORAGE		

☐ PRESENT METHOD
☐ PROPOSED METHOD

Dist (m)	Time (Min)	Chart Symbols	Description	Notes
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		TOTAL		

5

FLOW PROCESS CHART

JOB...

....

CHART BEGINS...............................

CHART ENDS..................................

CHARTED BY..................................

DATE..

CHART NO..........SHEET NO. ....OF....

WORK PLACE..................................

OPERATOR ....

CHART TYPE ☐ MAN ☐ MATERIAL
            ☐ EQUIPMENT

SUMMARY

	NUMBER	TIME/DIST
○ OPERATION		
⇨ TRANSPORTATION		
☐ INSPECTION		
D DELAY		
▽ STORAGE		

☐ PRESENT METHOD
☐ PROPOSED METHOD

Dist (m)	Time (Min)	Chart Symbols	Description	Notes
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		○ ⇨ ☐ D ▽		
		TOTAL		

4. Assume that the man-machine situation for a food company is presented in figure 1 (Plan A) and figure 2 (Plan B). The relevant costs are:

Operator's wage	=	$5 per hour
Helper's wage	=	$3 per hour
Machine A's cost	=	$10 per hour
Machine B's cost	=	$15 per hour
Price of product	=	$5 per piece

Under this circumstance, which plan should be selected? (20 points)

Time	Operator	Machine
3	Make ready 1st unit	Idle
6		Working 1st unit
9	Idle	
12	Put away 1st unit	Idle
15	Make ready 2nd unit	
18		Working 2nd unit
21	Idle	
24	Put away 2nd unit	Idle

Figure 1. Man – Machine Chart- Machine A, Plan A

Time	Operator	Machine	Helper
2	Make ready 1st unit	Idle	
4		Working 1st unit	Idle
6	Idle		
8	Make ready 2nd unit	Idle	Put away 1st unit
10		Working 2nd unit	Idle
12	Idle		
14	Make ready 3rd unit	Idle	Put away 2nd unit
16	Idle	Working 3rd unit	Idle

Figure 2. Man – Machine Chart- Machine B, Plan B

5. How many machines should be assigned to an operator when:
    a. Loading time on one machine is 1 minute
    b. Machine time is 4 minutes
    c. Unloading time is 1minute
    d. Operator rate is $10.00 per hour
    e. Machine rate is $80.00 per hour
    f. Product price is $10.00 per piece

    (20 points)

Name……………………………………………………..Code…………………

time	Man	M/C1
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		

time	Man	M/C1	M/C2
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			

12

Name……………………………………………………………..Code…………………….

time	Man	M/C1	M/C2	M/C3
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				

time	Man	M/C1	M/C2	M/C3	M/C4
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					

13

6. An operations manager has narrowed the search for a new facility location to four communities. The annual fixed costs (land, property taxes, insurance, equipment, and buildings) and the variable costs (labor, materials, transportation, and variable overhead) are

Community	Fixed costs per year ($)	Variable costs per unit ($)
Hatyai	150,000	62
Pattani	300,000	38
Yala	500,000	24
Naratiwat	600,000	30

   a. Plot the total cost curves for all the communities on a single graph. Identify on the graph the approximate range over which each community provides the lowest cost

   b. Using break-even analysis, calculate the break-even quantities over the relevant ranges. If the expected demand is 15,000 units per year, what is the best location?

(20 points)

15

7. Four products are produced in a facility of five departments. The routing for these products and their forecasted production rates are

Product	Routing	Forecasted production (in units/week)
A	A-B-C-D-E	200
B	A-D-E	900
C	A-B-C-E	400
D	A-C-D-E	650

Suppose that all four products are produced in batches of size 50.
a. Convert this information into a from-to-chart (using the number of materials handling trips per week between department)
b. Based on the result of part a. would you recommend a basic layout for this facility?

(20 points)

	A	B	C	D	E
A					
B					
C					
D					
E					

18