PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Final Examination : Semester I **Academic Year** : 2005

Date : October 03, 2005 **Time** : 1:30 - 4:30 PM

Subject : 225 - 344 Work Study and Industrial Plant **Room** : R 300

Before doing this test, please read this first!

1. The following materials can be led into examination room :-
   - Lecture notes, handouts, or textbooks.
   - Electronic handheld calculator and language translate equipment.
2. Not allow for communication equipment such as PDA phone, mobile telephone, and laptop (notebook) computer.
3. You have to write answers to ALL questions.
4. You have to fill your name and ID on this page and on the top right of the remainder.
5. Total score is 30.

ทุจริตในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น และ
พักการเรียน 1 ภาคการศึกษา โทษสูงสุด ให้ออก

First name Mr./Miss ..... Surname .....

Student ID .....

Score (fill by lecturer)

Part I		Part II		
points	your score	Q	points	your score
10		1	3	
		2	3	
		3	5	
		4	3	
		5	2	
		6	4	
			20	

This test is prepared by Asst. Prof. Charoen Jaitwijitra

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Part I – (10 points) Choose answers from Table 1 and fill in the blanks of each question. Some answers may be used more than once. If you think that a problems has no answer you should fill the character X in the blank of that problem.

Table 1

Finishing time	Unaccounted time	Observed time	Snapback timing	Total check time
Selected time	Normal time	Effective time	Confidence interval	Fatigue allowance
Unavoidable delay	Policy allowance	Special allowance	Recording error	
Continuous timing	Avoidable delay	X (no answer)		

1. Time added for worker so as to talk with foreman = ...
2. Performance rating multiply by selected time = ...
3. Elapsed time + starting time = ...
4. Standard time divide by (1+allowances) = ...
5. Time study technique in which, after the watch is read at the breakpoint of each element, the time is **not** returned to zero. .....
6. An extra times needed for a worker who is assigned to manipulate more than one machines and the machines are waiting for the worker after they finish from automatic operations .....
7. Times added for a task with deteriorate raw material which requires more times to work .....
8. Time added for physical and/or mental tired .....
9. The ratio of the operator's actual production to the standard production. .....
10. The delay that should not included in standard time .....

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Part II- (6 problems worth 20 points) Fill your answers in the blank of each question.

1. (3 points) If the standard deviation of population is 0.05 minutes and the sample mean is 1.10 minutes, determine the upper and lower limits of true mean (μ) when the 99 per cent confidence interval is required. The normal distribution is assumed and number of observations = 100.

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2. (3 points) Compute the maximum number of "idle hours per day" (8 working hours a day) when the work sampling result indicates that 10 workers were not working 100 times out of 400 times. The 97% confidence level is specified.

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3. The details of a time-study's results shown on figure 1 to 3 below. You will find many fields on the Figure 3 are hidden.

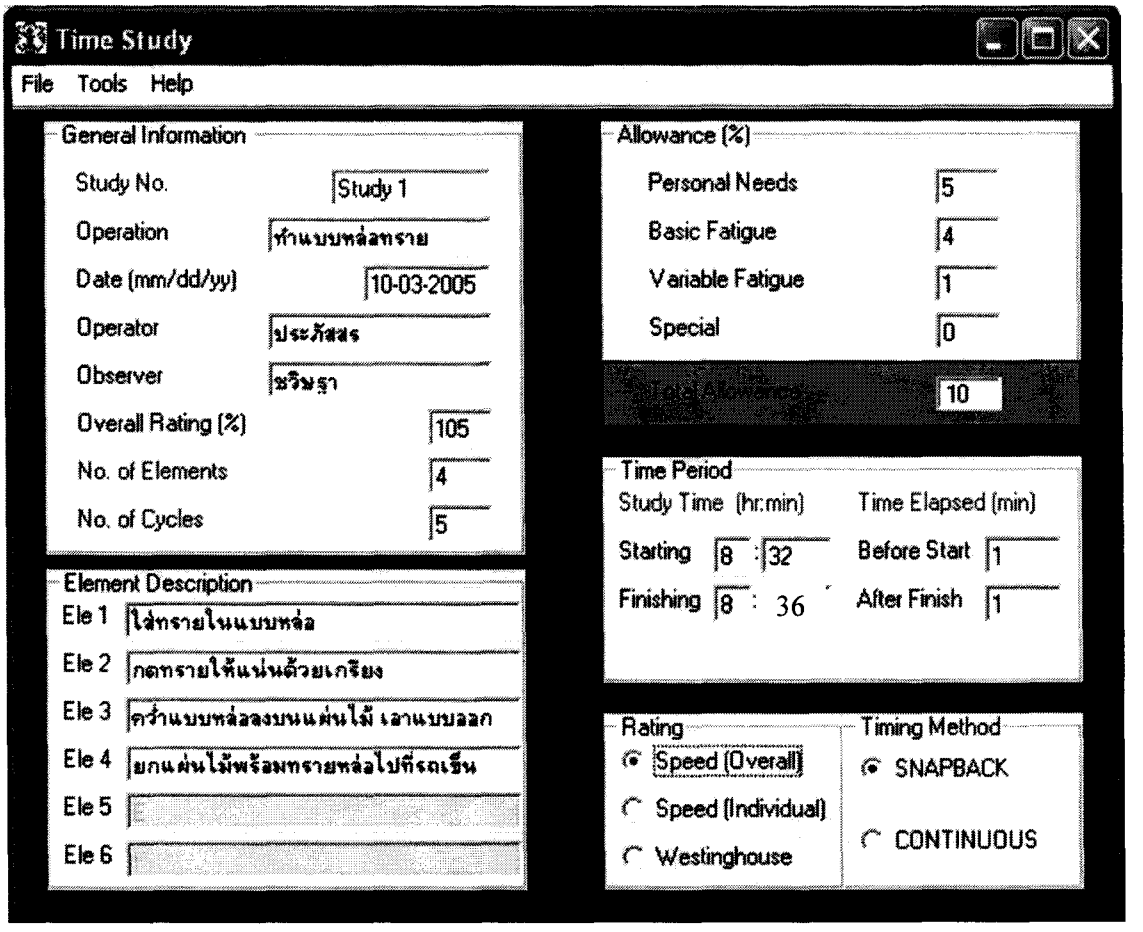

Figure 1. Time study main window

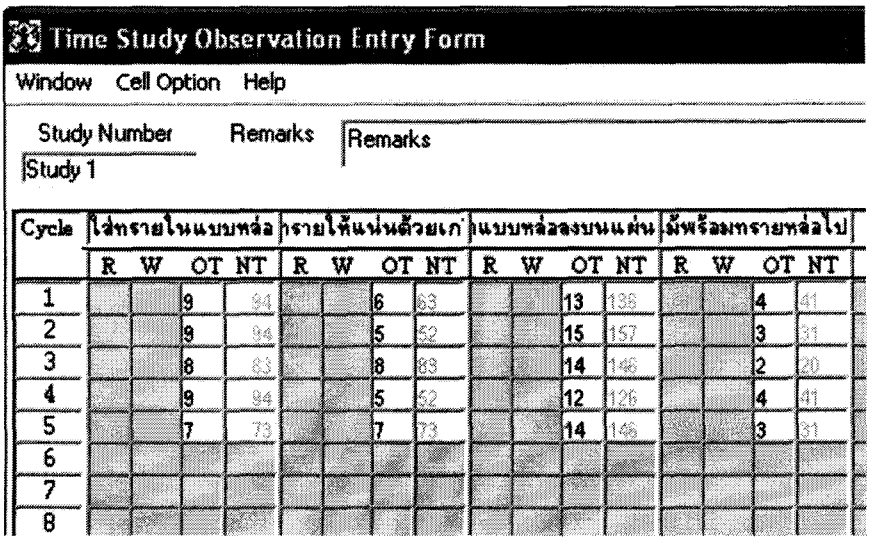

Figure 2. Observation entry form

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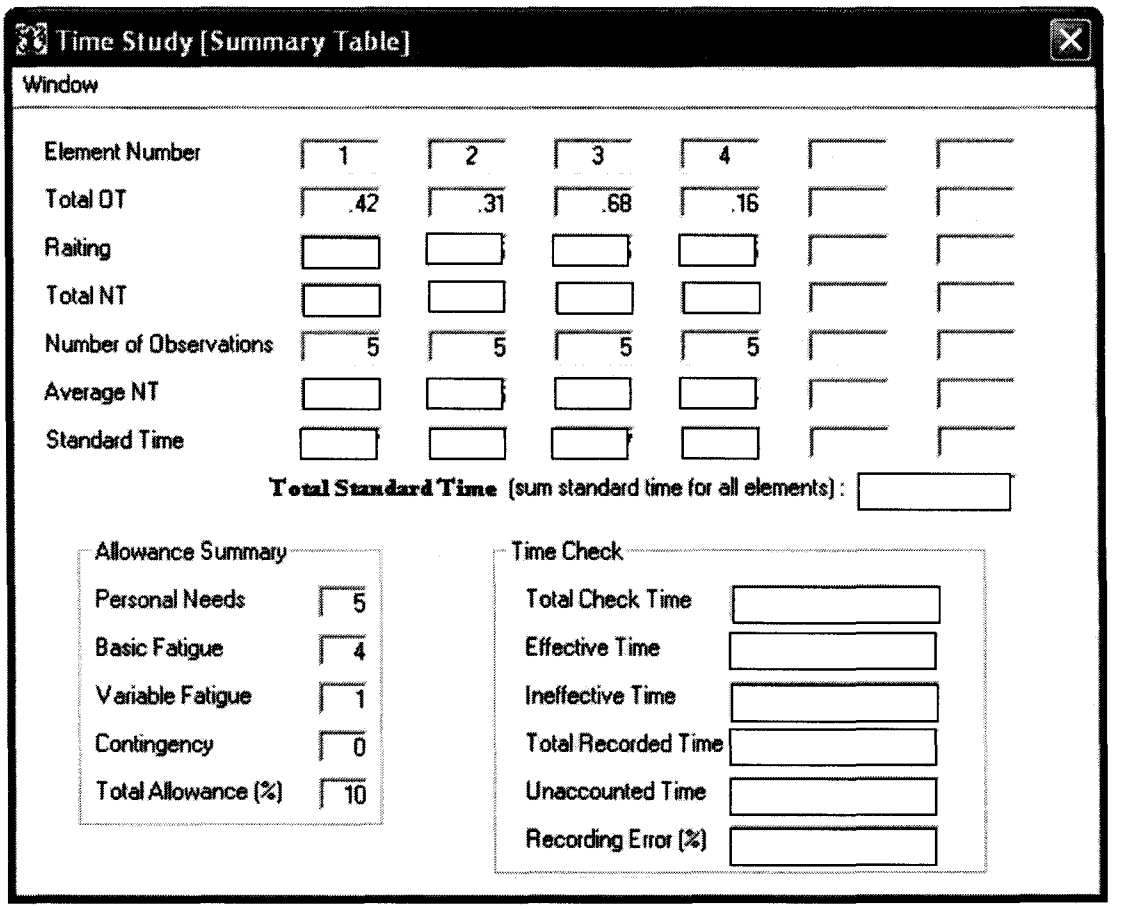

Figure 3. Summary table

3.1. (2 points) Calculate standard times for each element. (Use the following formula to calculate standard time :

Standard time = Normal time (1 + allowances))

Your answers have to 4 digits.

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3.2. (3 points) Calculate total recorded time and recording error (in percent).

4. (3 points) A Manufacturing engineer in the Songkhla Para wood Company is developing standard data of a cutting time of specific low carbon steel for lathe. The recommended cutting speed and feed rate for high-speed cutter bit are 130 feet per minute and 0.015 inches per revolution respectively. Calculate the cutting time in minutes when the total length of cut is 4.50 inches and the workpiece diameter is 0.75 inches.

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5. (2 points) The following figures show steps of bolt and washer assembly. The assembly part includes of bolt, rubber washer, plain steel washer, and spring washer.

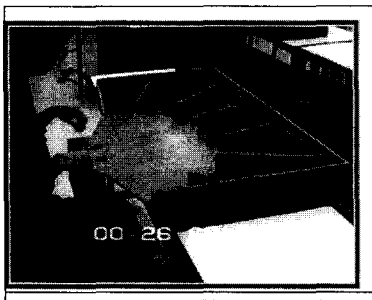

fig. 1 Starting position for each cycle.

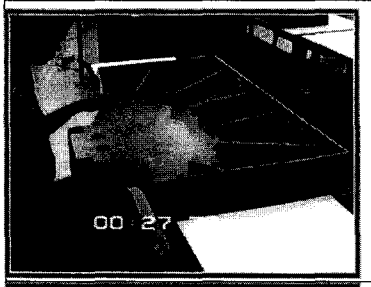

fig.2 Reach for rubber washers, draw to fixtures.

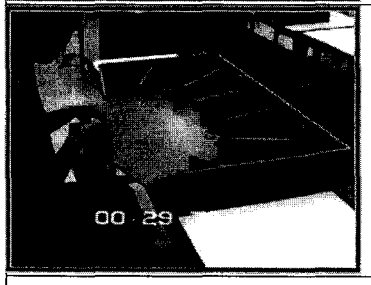

fig.3 Place washers to fixtures' holes.

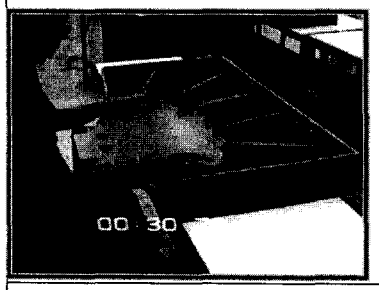

fig.4 Reach for plain steel washers, draw to fixtures.

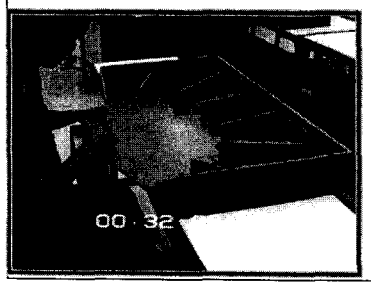

fig.5 Place steel washers to fixtures' holes.

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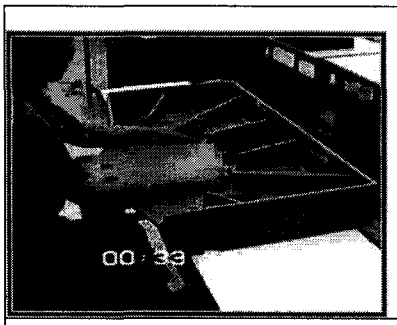
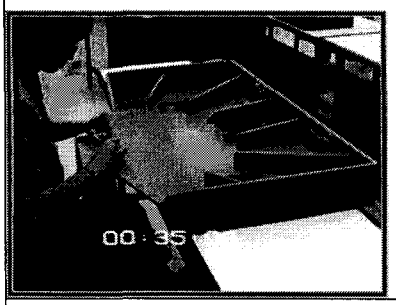
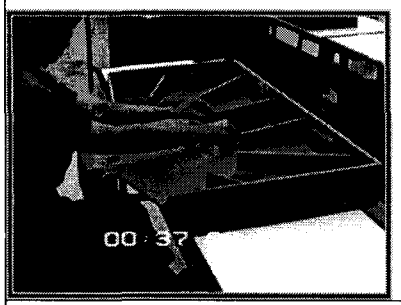
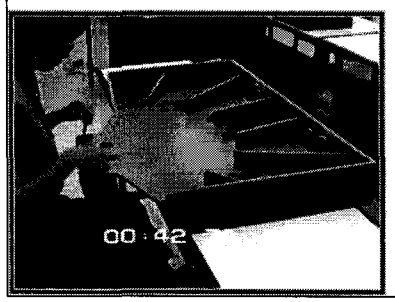
	fig.6 Reach for spring washers, draw to fixtures.
	fig.7 Place spring washers to fixtures' holes.
	fig.8 Reach for bolts, grasp and move through the air to fixtures.
	fig. 9 Push bolt's ends to the fixtures (through all washers) with light pressure.
	fig. 10 Lift up the parts, then move to the top of gravity chutes and drop them to chutes.

5.1. (1 point) Use fig. 1 to 3 for generating the Basic MOST sequence model and the times used for this sequence in TMU. (Use the controlled move model)

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5.2. (1 point) use fig. 7 to 9 for generating the Basic MOST sequence model and the times used for this sequence in TMU. (Use the general move model)

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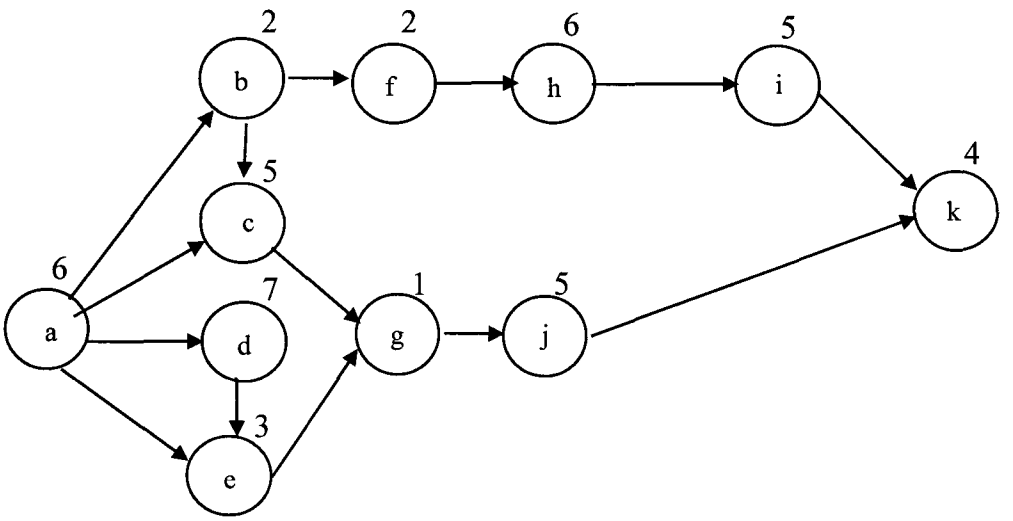
6. (4 points) The precedence diagram shown below is used for balancing times for workstations. Solves this problem by the Ranked Positional Weight method. The cycle time is 9 seconds.



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