

PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Final Examination : Semester II

Academic Year : 2004

Date : March 1, 2005

Time : 1:30 - 4:30 PM

Subject : 225 - 346 Work Study

Room : R 201

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.
 - Languages translate equipment.
2. Not allow for communication equipment such as Personal Digital Assistant (PDA), mobile telephone, and laptop (notebook) computer.
3. You have to write answers to ALL questions.
4. Fill your name, ID, and section on this page and on the top right of the remainder.
5. Total score is 22 points.

ทูลจริตในการสอบ โทษขั้นต่ำปรับตักในรายวิชานี้

First name Mr./Miss Last name

Student ID Section 01 02 03 04

Score (fill by lecturer)

| Part I | | Part II | | |
|--------|------------|---------|--------|------------|
| points | your score | Q | points | your score |
| 5 | | 1 | 2 | |
| | | 2 | 2 | |
| | | 3 | 3 | |
| | | 4 | 2 | |
| | | 5 | 2 | |
| | | 6 | 3 | |
| | | 7 | 3 | |
| | | | 17 | |

Test is prepared by Asst. Prof. Charoen Jaitwijitra

Name

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Part I – (5 points) Matching. Next to each definition in column A place the best term (letter only) from column B. The same answer can be used more than once, or none may apply (then use letter X).

| Column A | | Column B |
|----------|---|------------------------------|
| | 1. May be value of mean, mode, or median. | A Elapsed time |
| | 2. Element which include short duration of foreign element and the analyst could not separate it. | B Unaccounted time |
| | 3. Normal time divided by performance rating = | C Ineffective time |
| | 4. The different time between finishing time and starting time is called ... | D Personal needs allowance |
| | 5. Sum of foreign element times is called ... | E Setup time |
| | 6. Recording error multiply by elapsed time = | F Outlier |
| | 7. Time the worker is not working is called ... | G Recording error |
| | 8. (Rating factor)(Selected time) = | H Observed time |
| | 9. The simple technique used for estimating the number of observations is proposed by ... | I Standard time |
| | 10. The number of time readings needed to analyze a standard time (when the standard deviation is fixed) is depended on the required accuracy and ... | J Westinghouse Rating System |
| | 11. The delay which have to included to standard time is called ... | K Total checked time |
| | 12. Compose of physical and mental types. | L Breakpoint |
| | 13. The ratio that should not be greater than 0.02 | M Avoidable delays |
| | 14. The amount of time pass before operator start the first work element of the first cycle is called | N Maytag Company |
| | 15. Total checked time minus TEAF | O TEBS |
| | | P Normal time |
| | | Q Fatigue allowance |
| | | R Unavoidable delays |
| | | S TEAF |
| | | T Selected time |
| | | U Gilbreth |
| | | X none apply |

Name

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Part II- (7 problems worth 17 points) Write your answers on the blank area of each problems.

1. (2 points) When the width of confidence interval is changed from 90% to 95%, how many percent of the width increased if the standard deviation σ and sample size n unchanged?

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2. (2 points) The data shown below is collected from a time study taken on a milling machine:

| | |
|---|--------------------------------------|
| Average cutting time (automatic feed) per cycle | 2.15 minutes |
| Average operator working time per cycle | 1.45 minutes |
| Overall operator's rating | 105% |
| Fatigue allowance | 10% |
| Personal needed allowance | 24 minutes of 480 on the job minutes |

Compute the standard time for this operation. Hint: performance rating is specified for operator only, not for machine.

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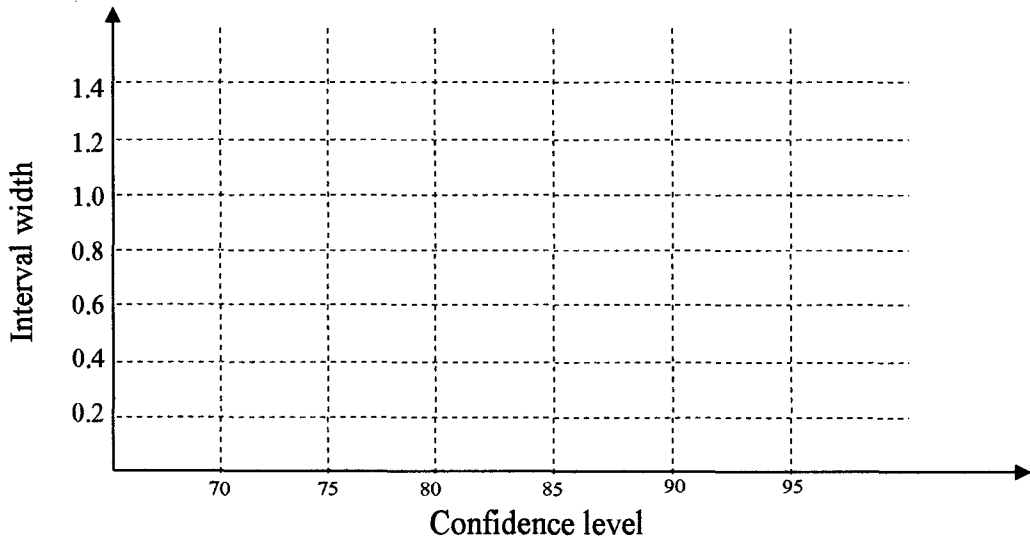
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3. (3 points) Staffs of Engineering Department of the ABC Manufacturing Company is being work out of the direct time study job and want to know the relationships of the width of error (interval width) and confidence level. If the confidence levels start from 70 to 95 percent, the number of cycles is 36, and the standard deviation is 2.

Fill your answers in the blank fields of the table.

| Confidence level | z value | Error (accuracy) | Interval width |
|------------------|---------|------------------|----------------|
| 70% | | | |
| 75% | | | |
| 80% | | | |
| 85% | | | |
| 90% | | | |
| 95% | | | |

Use the data from the table to plot linear graph.



Name

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4. (2 points) Mr. Charoen, who has responsible for determining the production capacity, has been collected the necessary data for computing the capacity. If he found that the standard time per piece is 1.15 minutes, total allowance is 10 percent, the performance index is 90 percent, and the working time is 75 percent. What is the total number of pieces produced per day? The daily production starts from 8:00 – 12:00, and 13:00 – 17:00 hours.

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5. (2 points) An engineer, Sornram, in the Hatyai Steels Company is developing standard data of power feed cutting time of a specific plain carbon steel (0.25 to 0.50 percent of carbon) in the drill press department. The recommended speed and feed rate are 60 sfm and 0.0105 in per rev respectively. He uses 1/2 –inch high-speed drill with a 118 degree included angle to drill through material that is 1 1/8 – inch thick. Compute the cutting time.

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6. (3 points) The details of a time study's results as shown on figure 1 to 4 below. You will find many fields on the Figure 4 are attemptly hidden. Do not write any answers onto these figures, only the last table following to Figure 4 is the area where you will fill your answers.

| General Information | |
|---------------------|-------------------|
| Study No. | เครื่อง 1 |
| Operation | การประกอบ washers |
| Date (mm/dd/yy) | 02-21-2005 |
| Operator | ทนาย ศรราม |
| Observer | นาย สุจิตรา |
| Overall Rating (%) | 106 |
| No. of Elements | 5 |
| No. of Cycles | 6 |

| Allowance (%) | |
|------------------------|----------|
| Personal Needs | 5 |
| Basic Fatigue | 4 |
| Variable Fatigue | 0 |
| Special | 0 |
| Total Allowance | 9 |

| Time Period | |
|---------------------|--------------------|
| Study Time (hr:min) | Time Elapsed (min) |
| Starting 9 : 00 | Before Start 1.50 |
| Finishing 9 : 02 | After Finish 0.50 |
| Study 2 Min. | |

| Element Description | |
|---------------------|-----------------------------------|
| Ele 1 | นำทวนยาวใส่ลงใน fixture |
| Ele 2 | นำทวนเหล็กใส่ลงใน fixture |
| Ele 3 | นำทวนสปริงใส่ลงใน fixture |
| Ele 4 | นำสลักเกลียวสอดผ่านทวน |
| Ele 5 | นำชิ้นงานประกอบบนตัวทวนลงใน chute |
| Ele 6 | |

| Rating | Timing Method |
|---|---|
| <input type="radio"/> Speed (Overall) | <input checked="" type="radio"/> SNAPBACK |
| <input type="radio"/> Speed (Individual) | <input type="radio"/> CONTINUOUS |
| <input checked="" type="radio"/> Westinghouse | |

Figure 1. Time study main window

| | | |
|---------------------------|-----------|-------------|
| Operator's Skill | C1 Good | .85 |
| Operator's Effort | C2 Good | .82 |
| Operator's Consistency | E Fair | .82 |
| Working Conditions | D Average | 0 |
| Performance Factor | | 1.86 |

OK Cancel

Figure 2. Time study rating (Westinghouse systems)

Name

ID

| | Element 1 | | Element 2 | | Element 3 | | Element 4 | | Element 5 | |
|---------|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|
| | OT | NT | OT | NT | OT | NT | OT | NT | OT | NT |
| Cycle 1 | 3 | 31 | 5 | 53 | 4 | 42 | 5 | 53 | 4 | 42 |
| 2 | 5 | 53 | 6 | 63 | 6 | 63 | 7 | 74 | 2 | 21 |
| 3 | 4 | 42 | 5 | 53 | 6 | 63 | 4 | 42 | 3 | 31 |
| 4 | 5 | 53 | 5 | 63 | 5 | 53 | 5 | 53 | 4 | 42 |
| 5 | 5 | 53 | 4 | 42 | 4 | 42 | 4 | 42 | 3 | 31 |
| 6 | 4 | 42 | 5 | 53 | 6 | 63 | 4 | 42 | 3 | 31 |

Figure 3. Observed and normal Times

Time Study [Summary Table]

Window

| | | | | | | |
|---|------|------|------|------|------|---|
| Element Number | 1 | 2 | 3 | 4 | 5 | |
| Total OT | A | B | C | D | E | |
| Rating | 106 | 106 | 106 | 106 | 106 | |
| Total NT | .276 | F | G | H | .201 | |
| Number of Observations | 6 | 6 | 6 | 6 | 6 | |
| Average NT | I | J | K | .051 | L | |
| Standard Time | .05 | .059 | .059 | .055 | .036 | |
| Total Standard Time (sum standard time for all elements): | | | | | | M |

Allowance Summary

Personal Needs

Basic Fatigue

Variable Fatigue

Contingency

Total Allowance (%)

Time Check

Total Check Time

Effective Time

Ineffective Time

Total Recorded Time

Unaccounted Time

Recording Error (%)

Figure 4. Summary table

Name

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The letters "A" to "R" indicate the blanked fields, which need to fill answers to them. Write your answers to the following table. The units of your answers are "minutes".

| Letter | Your answers | | Letter | Your answers |
|--------|--------------|--|--------|--------------|
| A | | | J | |
| B | | | K | |
| C | | | L | |
| D | | | M | |
| E | | | N | |
| F | | | O | |
| G | | | P | |
| H | | | Q | |
| I | | | R | |

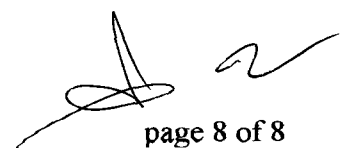
7. (3 points) Use the Maynard Operation Sequence Technique for analyzing the following operations. You have to write the sequence model and their indexes, and then find their TMUs.

7.1. Hold a screwdriver with right hand, walk five steps to bench, and place it on the bench with adjustment.

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7.2. A worker holding a bolt on right hand waiting for assembles with a plain steel washer, and then he grasps a washer, which is placed within reach with left hand, moves it near to bolt and insert bolt to washer.

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