

**PRINCE OF SONGKLA UNIVERSITY**  
**FACULTY OF ENGINEERING**

**Final Examination:** Semester 2

**Academic Year:** 2010

**Date:** 3 March 2011

**Time:** 09.00-12.00 (3 hours)

**Subject Number:** 241-500

**Room:** ห้อง 400

**Subject Title:** Research and Development Methodologies

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**Exam Duration:** 3 hours

**This paper has 9 pages. It aims to collect 55 marks (25%).**

**Authorised Materials:**

- Writing instruments (e.g. pens, pencils), two A4 pages with handwriting and a dictionary are permitted.
- Textbooks, a notebook, handouts, are not permitted.

**Instructions to Students:**

- Scan all the questions before answering so that you can manage your time better.
- Write your answers in **Thai**.
- Write your name and ID on every page.
- Any unreadable parts will be considered wrong.

When drawing diagrams or coding, use good layout, and short comments; marks will not be deducted for minor syntax errors.

**Cheating in this examination**

Lowest punishment: Failed in this subject and courses dropped for next semester.

Highest punishment: Expelled.

NO	Marks	Collected	NO	Marks	Collected
1	4		7	3	
2	6		8	5	
3	5		<b>Total</b>	<b>55</b>	
4	23		%	100	
5	5		<b>25%</b>		
6	4				

**Question 1**

**(4 Marks)**

- a) Give a possible reason why two calculators give different results when repeating the calculation process. (1 mark)

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- b) Why is it not possible to forecast the weather in a long run? (1 mark)

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- c) Explain the phrase “sensitive to beginning conditions.” (1 mark)

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- d) Why do we need to care about the sampling method? (1 mark)

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**Question 2**

**(6 marks)**

- a) Why is the reliability of *a parallel system* better than the reliability of *a series system*? (2 marks)

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b) What can be done to make *System Hardware* reliable?(2 marks)

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c) What can be done to make *Software* reliable? (2 marks)

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**Question 3**

**(5 Marks)**

a) Explain the degree of freedom and how to calculate it. (1 mark)

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b) Why is the significant level of 0.01 still not enough in some cases? Give an example. (1 mark)

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- c) Compare two-tailed test and one-tailed test. (4 marks)

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**Question 4**

**(23 Marks)**

- a) What are the differences between *Descriptive* and *Inferential Statistics*. Also give at least two examples of each type? (4 marks)

Descriptive Statistics	Inferential Statistics

- b) Explain the factors in *Time Series* equation. (2 marks)

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- c) Compare Chi-square Test and Pearson Product Moment Correlation (Rxy). (2 marks)

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- d) Give an example of how and why *Simple Random Sampling* can be vulnerable to sampling error. (2 marks)

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- e) In which case is *Systematic Sampling* less accurate than *Simple Random Sampling*? (1 mark)

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- f) Compare F-Test and T-Test. (2 marks)

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- g) Compare *False Positive* and *False Negative* and give examples. (4 marks)

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h) What is the power of a statistical hypothesis test? What will happen if we vary the power? (2 marks)

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i) What will happen if we use a larger significance criterion in order to increase the power of a test? (2 marks)

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j) List possible cases of groups for T-Test. (2 marks)

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**Question 5 (5 Marks)**

From a) to e), read the cases and tell whether they are *Probability* or *Non-Probability Sampling*.

From f) to g), just answer the questions.

a) Interview 200 people between the age of 25 and 40 for their satisfaction about the prime minister.

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b) Assign each person a random number between 0 and 10, and select the person with the highest number in each village. Then accumulate the income of the selected people in order to represent the picture of all population in the Thailand.

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k) At first stage, randomly select samples of areas. Later randomly select a sample each within those chosen areas in order to represent the whole population.

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l) Select every 20th student from the student IDs to calculate the GPA of all PSU students.

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m) Interview selected Japanese CEOs in Thailand and take them as the representatives of the whole Japanese business in Thailand.

**Question 6**

**(4 Marks)**

a) Give examples of *Quantitative Variables* and *Qualitative Variables*. Give 2 examples each. (2 marks)

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b) Give examples of *Independent Variables* and *Dependent Variables*. Give 2 examples each. (2 marks)

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Name \_\_\_\_\_ ID \_\_\_\_\_

From the following problems, tell which statistic methods are applicable.

a) You would like to know the relationship between the problem size (say, the size of the image) and the execution time of an image processing algorithm.

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b) You would like to check whether sensors of a certain type in a wireless sensor network, applying 5 different communication protocols yield different average life times or not. You collect 10

e) You would like to predict the number of packets sent in the department network this year by analyzing previous data over the past 5 years. Also, you are aware that the overall behavior of the users changes each month. For example, more utilization during the first and second semesters, and less during October and summer. Or more utilization during the evening and less in the morning.

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----- **End of Examination** -----

Written by Pichaya Tandayya

It is much more difficult being as you are than trying to be anybody else.  
We often misunderstand that struggling to be whom you wish to be is an act of liberation. Actually, we would just be caught in another illusion after another.

After having fulfilled one dream, there comes another.  
Learning that all desires are meaningless is a real liberation.



**Question 7****(3 Marks)**

From the following *selling points*, what kind of data and results should they be?

Data	Results	Selling Points
		What has been found? Solve a new problem.
		A new method that is simpler or cheaper. How?
		A new method that is more reliable or comparable. What is the difference?

**Question 8****(5 Marks)**

From the following problems, tell which statistic methods are applicable.

- a) You would like to know the relationship between the problem size (say, the size of the image) and the execution time of an image processing algorithm.
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- b) You would like to check whether sensors of a certain type in a wireless sensor network, applying 5 different communication protocols, yield different average life times or not. You collect 10 samples for each protocol.
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- c) You would like to know how bright a certain LED can produce light when you vary the current. You measure the illumination in Lumens. You use 6 samples for each current value, say 1 mA, 2 mA, 3 mA, 4 mA and 5 mA. You would like to know exactly which current produces how bright the light is in Lumens.
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- d) You would like to compare whether there is a significant improvement in false negative results of a speech recognition method after you add a filter.
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