PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Midterm Examination: Semester 1 **Academic Year**: 2013

Date: 9 October 2013 **Time**: 13.30 - 16.30 (3 hours)

Subject Number: 242-530 **Room**: S817

Subject Title: Parallel and Distributed Computing

Exam Duration: **3 hours**.

This paper has 14 pages, 7 questions and 160 marks (30%).

Authorised Materials:

- Writing instruments (e.g. pens, pencils).
- Textbooks, a notebook, handouts, and dictionaries are permitted.

Instructions to Students:

- Scan all the questions before answering so that you can manage your time better.
- Answers **must** be written 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	Time (Min)	Marks	Collected	NO	Time (Min)	Marks	Collected
1	30	31		5	25	20	
2	20	16		6	20	20	
3	45	43		7	20	20	
4	15	10	Raw marks (160)		100%	Collected (30%)	
Total	175	160					

Question 1 (31 marks; 30 minutes)

Answer the following questions about *Parallel Algorithm Design*.

Use Figure 1.1 for answering Questions a) - b)

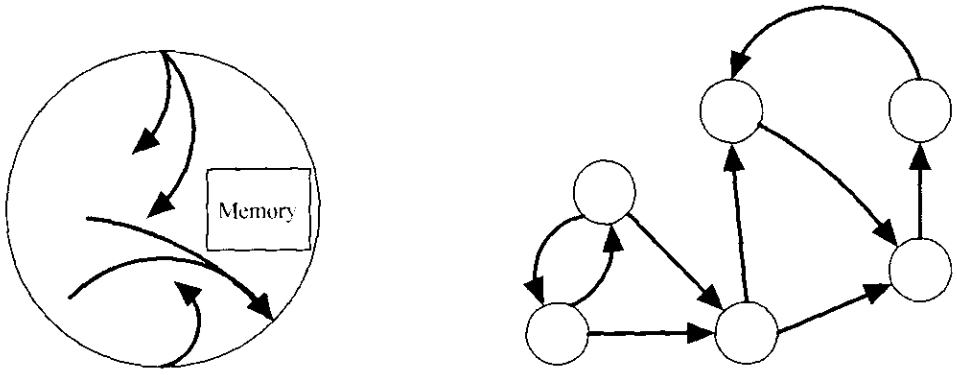
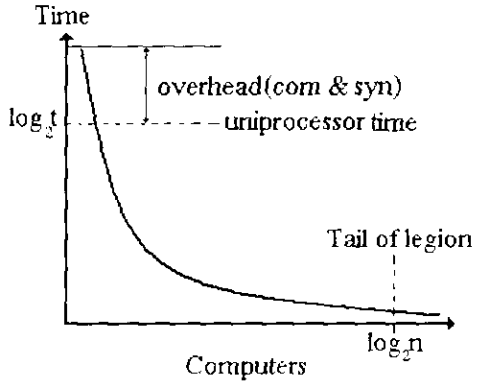


Figure 1.1 Task and Channel Model

a) Explain Figure 1.1. (2 marks)

b) What does a task consist of? (3 marks)

Use Figure 1.2 for answering Questions c) - d)



Typical performance graph

Figure 1.2 Typical Performance Graph

c) When *too small number of processors* are used in parallel computing, what will happen? (1 mark)

d) From Figure 1.2, explain when *Tail of Legion* occurs. (2 marks)

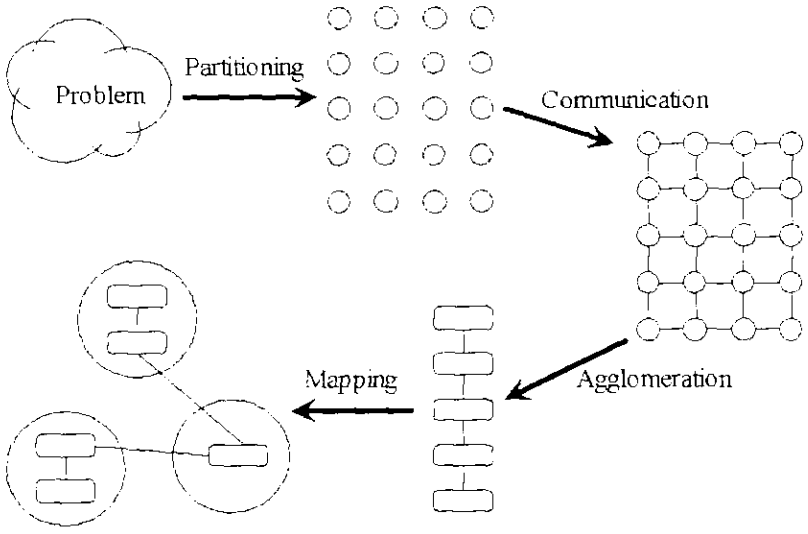


Figure 1.3 Foster's Methodology

e) Use Figure 1.3 to explain *what need to be done* in the design methodology. (5 marks)

f) What are *the conflicting goals* of mapping in Foster's methodology? (2 marks)

g) Explain the *Partitioning Checklist.* (4 marks)

h) Explain the *Communication Checklist.* (4 marks)

i) Explain the *Agglomeration Checklist.* (4 marks)

j) Explain the *Mapping Checklist.* (4 marks)

Name_____ ID_____

Question 2 (16 marks; 20 minutes)

Answer the following questions about *Performance Analysis*.

a) What are 4 *Performance Matrices*? Also explain their *measurements*. (4 marks)

b) Explain *how to increase throughput* in parallel computing. (2 marks)

c) What is a good factor for *measuring the cost-effectiveness*? (1 mark)

d) What are the importance parameters for *Memory Performance* and how to measure them? (3 marks)

e) What is a *scalable system*? How to measure the scalability of a system? (3 marks)

f) What is *Isoefficiency Function*? How should its value be in order to make a good scalable system? (3 marks)

Name_____ ID_____

Question 3 (43 marks; 45 minutes)

Answer the following questions about *Load Balancing*.

a) Why is *Load Balancing* necessary? (3 marks)

b) What are differences between *Static* and *Dynamic* Load Balancing? (4 marks)

c) Compare the following basic techniques of Load Balancing. Use figures to help explanation. (16 marks)

Bin Packing	*Pressure Models*

Name_____ ID_____

Randomization	*Manager-Worker*

d) What are *Dynamic Load Balancing Factors?* (3 marks)

e) Give 5 examples of *Processor Load Measurements.* (5 marks)

Name_____ ID_____

f) What are *Migration Rules?* (6 marks)

g) Explain at least 6 *properties of Load Balancing Systems.* (6 marks)

Question 4 (10 marks; 15 minutes)

Draw graphs that illustrate the following items of Amdahl Laws. Give details of all axes and legends. Also, briefly explain the graphs accordingly.

a) Typical plot for showing the scalability of a parallel system (speedup changes as the problem size and the number of processors change). (4 marks)

b) Typical efficiency plot for a fixed problem size. (3 marks)

c) Typical efficiency plot for a fixed number of processors. (3 marks)

Question 5 (20 marks; 25 minutes)

Manually sort the following array (from small to large) using the parallel quick sort algorithm. Suppose that the number of processors is 4. Also explain how to divide the items to processors and specify the pivot(s) for each round. Apply the following additional method. Demonstrate the details of each round. Hence: It takes 4 rounds.

45, 65, 18, 58, 65, 22, 85, 65, 67, 10, 70, 99, 75, 95, 15, 60, 19, 8, 89, 58, 49, 13, 47

1) Always pick the first element to be a pivot on a pre-sorted array.

2) After each big round, place the pivot(s) in the middle of the array and do not mix it/them with the unsorted items.

3) If the whole unsorted sub-array is assigned to only 1 processor in that round and the number of quick sort divided items (by that round's pivot) is <= 4, then use another sorting algorithm.

Question 6 (20 marks; 20 minutes)

Answer the following questions about *Grid Technology.*

a) Use Figures 6.1 and 6.2 to help compare *traditional grid-enable application* and *service-oriented grid application.* (10 marks)

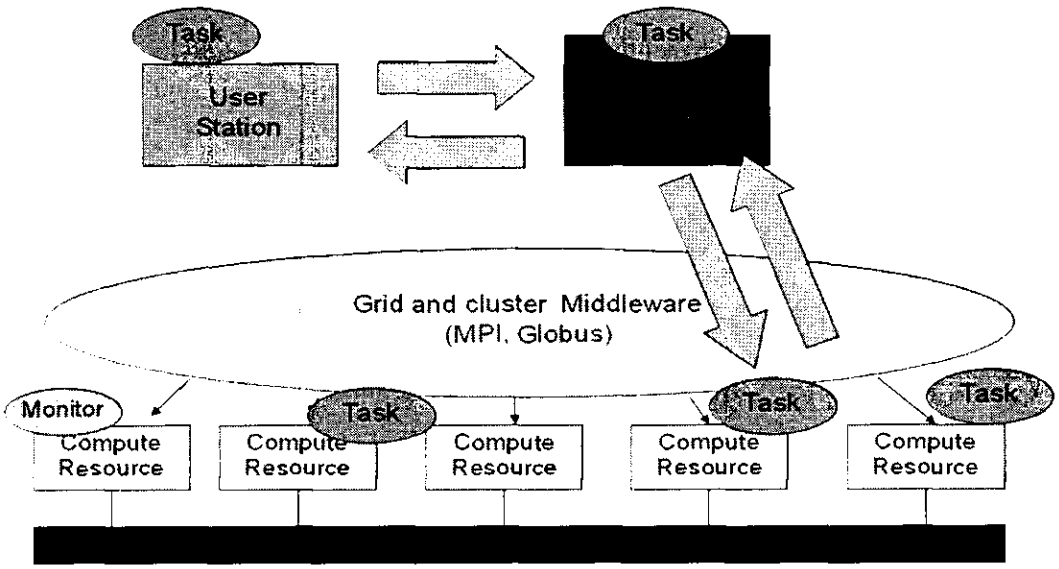


Figure 6.1 Traditional Grid Enable Application

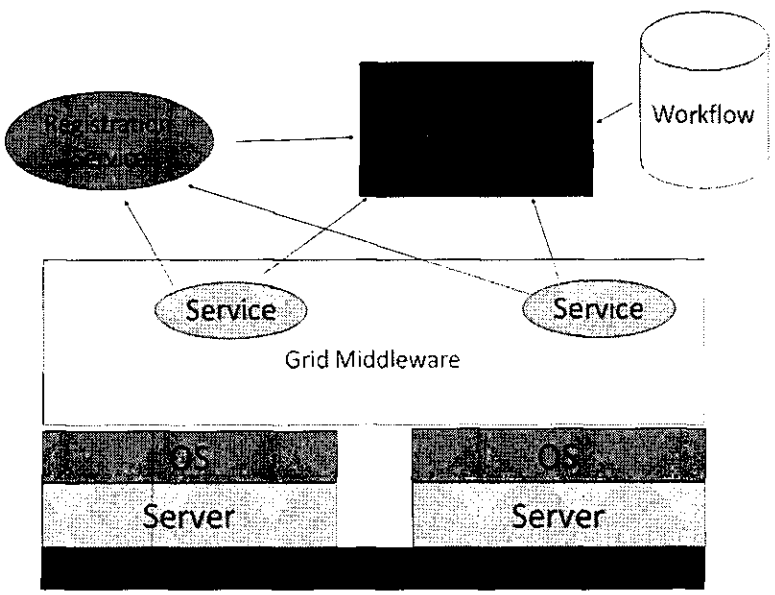


Figure 6.2 Service Oriented Grid

Name _____ ID _____

b) Explain how *workflow technology* helps grid applications. Draw a diagram to help explanation. (10 marks)

Question 7 (20 marks; 20 minutes)

Answer the following questions about *Cloud Computing*.

a) Use Figures 7.1 and 7.2 to help explain how the Pay-By-Use concept of Cloud Computing helps avoiding under-provisioning. (10 marks)

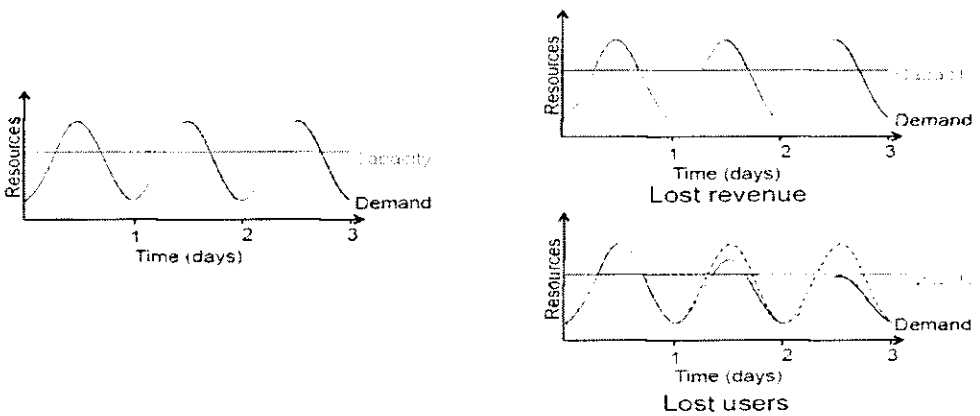


Figure 7.1 Heavy penalty in under-provisioning

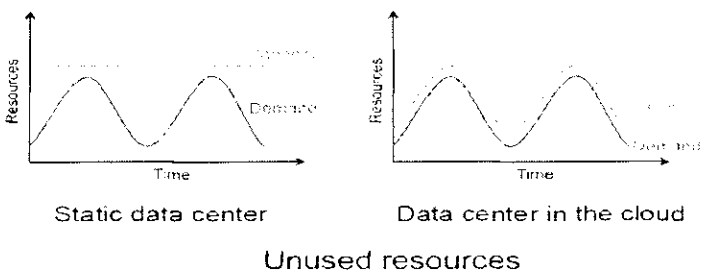


Figure 7.2 Comparison between Static Data Center and Data Center in the Cloud

Name_____ ID_____

b) Explain three cloud models as shown in the below figure. Also give examples of applications applying the three models. (10 marks)

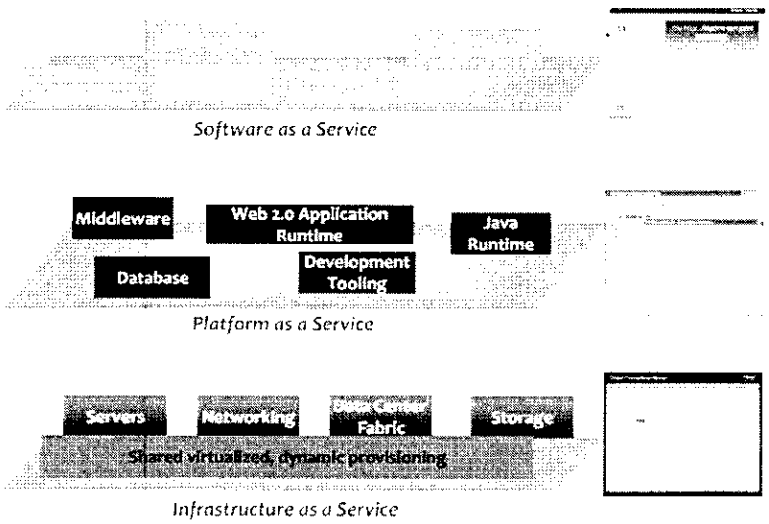


Figure 7.3 The Three Cloud Models

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Pichaya Tandayya Lecturer

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