PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Midterm Examination: Semester 1 **Academic Year**: 2012

Date: 9 October 2012 **Time**: 13.30 - 16.30 (3 hours)

Subject Number: 242-530 **Room**: R201

Subject Title: Parallel and Distributed Computing

Exam Duration: 3 hours

This paper has 13 pages, 7 questions and 135 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.

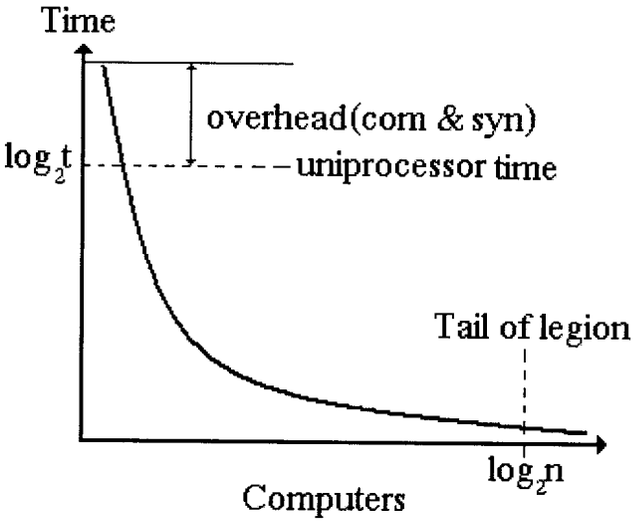
Highest punishment: Expelled.

NO	Time (Min)	Marks	Collected	NO	Time (Min)	Marks	Collected
1	15	10		5	15	10	
2	20	16		6	30	20	
3	40	36		7	40	30	
4	15	13	Raw marks (135)		100%	Collected (30%)	
Total	175	135					

Question 1 (10 marks; 15 minutes)

Answer the following questions about *Parallel Algorithm Design*.

The below figure is for answering Question a) - b)



Typical performance graph

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

b) From the following figure, explain when will *Tail of Legion* occur? (2 marks)

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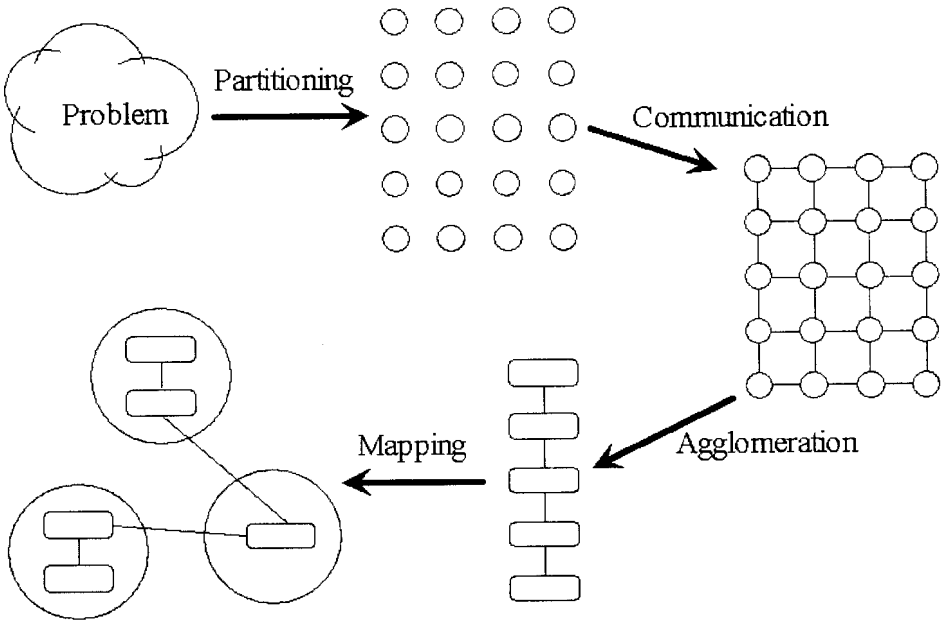
Use the following figure for explaining what need to be done in the design methodology in Question c) – j).



c) Partitioning (1 mark)

d) Communication (1 mark)

e) Agglomeration (1 mark)

f) Granularity (1 mark)

g) Mapping (1 mark)

h) What are the conflicting goals of mapping? (2 marks)

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Question 2 (16 marks; 20 minutes)

Answer the following questions about *Performance Analysis*.

a) What are *Performance Matrices*? Also inform their definition. (4 marks)

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

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

Question 3 (36 marks; 40minutes)

Answer the following questions about *Load Balancing*.

a) Explain the strategies and basic principle of *Load Balancing*. (3 marks)

b) What are *Dynamic Load Balancing Factors?* (6 marks)

c) Explain at least 3 approaches concerning *System Information exchange policy?* (6 marks)

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

e) Explain the *Properties* of Load Balancing Systems. (7 marks)

f) Compare *Heuristic Approach* and *Graph Theoretic Approach* of *Static Load Balancing*. (8 marks)

Heuristic Approach	*The Graph Theoretic Approach*

Question 4 (13 marks; 15 minutes)

From the following list, put the matched items to the design methodology check lists.

A. Minimize redundant computations and redundant data storage
B. Communication operations balanced among tasks
C. Locality of parallel algorithm has increased
D. Each task communicates with only small group of neighbors
E. Replicated computations take less time than communications they replace
F. Number of tasks an increasing function of problem size
G. Data replication doesn't affect scalability
H. Tasks can perform communications concurrently
I. Primitive tasks roughly the same size
J. Number of tasks increases with problem size
K. Considered designs based on one task per processor and multiple tasks per processor
L. Number of tasks suitable for likely target systems
M. Evaluated static and dynamic task allocation

a) Partitioning

_____

_____

b) Communication

_____

_____

c) Agglomeration

_____

_____

d) Mapping

_____

_____

Question 5 (10 marks; 15 minutes)

Draw graphs that illustrate the following items of Amdahl Laws. Give details of all axes and legends.

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 problem size. (3 marks)

Question 6 (20 marks; 30 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.

42, 65, 16, 54, 66, 22, 83, 66, 67, 10, 70, 98, 75, 91, 15, 64, 21, 8, 88, 54, 50, 12, 47

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

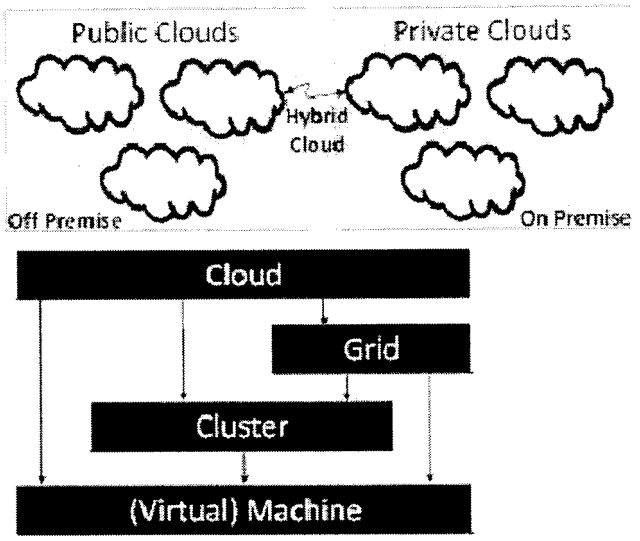
2) After each big round, place the pivot(s) in the middle of the array and do not mix it/them with the unsorted items.

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 7 (30 marks; 40 minutes)

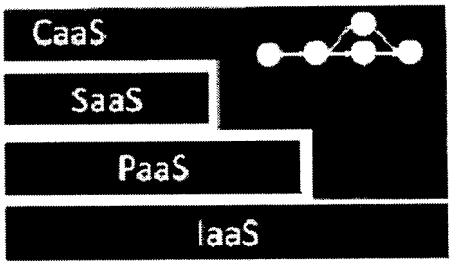
Answer the following questions about *Grid Technology and Cloud Computing.*

a) Describe and compare all keywords in the following figure and their relationship. (18 marks)



Name_____ ID_____

b) Explain and compare all keywords in the following figure when Composite as a Service (CaaS) includes Composite Services and composes a workflow that links and orchestrates distributed applications over the Internet. Also give some examples of such services. (12 marks)

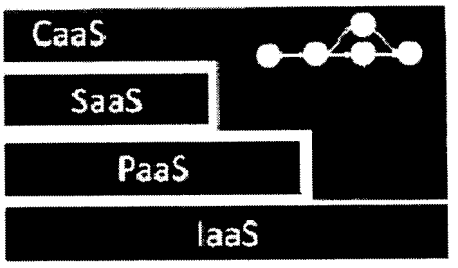


----End of Examination----

Pichaya Tandayya Lecturer

Name_____ ID_____

b) Explain and compare all keywords in the following figure when Composite as a Service (CaaS) includes Composite Services and composes a workflow that links and orchestrates distributed applications over the Internet. Also give some examples of such services. (12 marks)



----End of Examination----

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