PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester 1 **Academic Year**: 2009

Date: 2 ตุลาคม 2552 **Time**: 09.00-12.00 (3 hours)

Subject Number: 241-530 **Room**: หัวหุ่นยนต์

Subject Title: Parallel and Distributed Computing

Exam Duration: 3 hours

This paper has 11 pages, 8 questions and 140 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	20	16		3	10	6	
2	40	37		6	20	12	
3	20	16		7	10	7	
4	50	40		8	10	6	

Question 1 (16 marks; 20 minutes)

1) Compare *Static* and *Dynamic* Load Balancing? (6 marks)

Static Load Balancing	*Dynamic Load Balancing*

2) Explain how *Agglomeration* can improve performance and also some pictures to help with the explanation. (4 marks)

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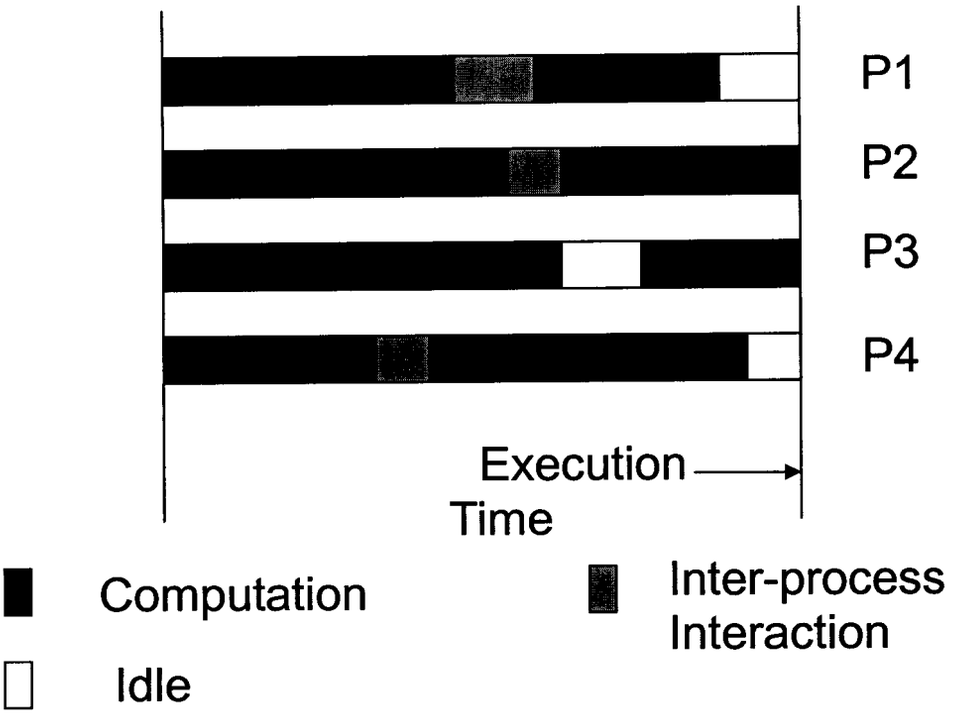
3) From the following picture of the execution of parallel processes, discuss how the *lengths* of the three states affect the *system performance*. (6 marks)



Name_____ ID_____

Question 2 (37 marks; 40 minutes)

Tell if the following statement true or false.

1) _____ In MPI programming, the goal is often to create as many agglomerated tasks per processor as possible.
2) _____ When granularity is increased, parallelism is increased and communication is also increased.
3) _____ The tasks use the same information should be grouped together to reduce communication.
4) _____ Execution time decreases as number of processors decreases.
5) _____ Manually developing parallel codes is a time consuming, complex, error-prone and iterative process.
6) _____ Loops are the most frequent target for automatic parallelization.
7) _____ If you are beginning with an existing serial code and have time and budget constraints, then automatic parallelization may be the answer.
8) _____ Pipelining and parallelism can be used to increase throughput.
9) _____ Cost-effectiveness means the shortest execution time.
10) _____ A good factor for measuring the cost-effectiveness is utilization.
11) _____ The utilization corresponds to the Gigaflops/cost of the purchasing price.
12) _____ System throughput is a number of jobs processed in a unit of time.
13) _____ Efficiency is the measure of the entire time for which a processor is employed.
14) _____ Amdahl's law ignores parallel overhead and often underestimates achievable speedup.
15) _____ Amdahl Effect states that for any fixed number of processors, speedup is usually an increasing function of the problem size.
16) _____ When a number of processors increases, the efficiency will increase.
17) _____ The parallel overhead depends on both the number of processors used and the problem size.
18) _____ The speedup/efficiency will decrease if the problem size increases keeping the number of processors fixed.
19) _____ The migration has to maximize the response time.
20) _____ In a scalable system, we can keep the speedup/efficiency fixed by increasing both the size of problem and number of processors.
21) _____ A scalable system maintains efficiency as processors are added
22) _____ For a given problem size, as the number of processors increases, the efficiency also increases.
23) _____ A big Isoefficiency function indicates that the parallel system is highly scalable.

24) _____ Load balance increases the application performance and system utilization.

25) _____ If an application causes a lot of memory paging, then the size of the free available memory is a good indicator of processor load.

26) _____ In Heuristic Static Load Balancing, the faster processors will then be assigned with more tasks.

27) _____ In Heuristic Static Load Balancing, we find a module pair with most inter-module communication and assign them to different processors

28) _____ In Load Balancing, when the traffic is heavy, information exchange should be stopped.

29) _____ In Load Balancing, it is common to consider moving an old process that is in execution for a long period of time rather than a new process.

30) _____ In Load Balancing Transfer Policy, we should migrate processes that communicate frequently with the intended destination processor to reduce communications load.

31) _____ In Load Balancing Transfer Policy, migrating the most locally demanding process will decrease the local load.

32) _____ Under heavy load conditions, the sender initiated load transfer performs better, where as the receiver initiated load transfer performs better under lower load conditions.

33) _____ Randomization polling works best on a heterogeneous system.

34) _____ Task transfer should not disrupt the communication locality.

35) _____ Reducing the number of tasks transferred is more important than reducing the size of the task transfer.

36) _____ WSDL is an XML format document that addresses the service description.

37) _____ OGSI is a core set of interfaces augmented from web service standard to include service creation, fault management, and other functions in order to enable service virtualization.

Question 3 (16 marks; 20 minutes)

From the following load balancing techniques, tell which is suitable for which kind of load.

1) Bin Packing (4 marks)

2) Randomization (4 marks)

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3) Pressure Model (4 marks)

4) Manager-Worker (4 marks)

Question 4 (40 marks; 50 minutes)

Propose ***a parallel*** algorithm for generating prime numbers up to n. It works by first generating the primes up to sqrt(n) and then using those to sieve the values up to n. **Explain and demonstrate** how to partition data with your proposed algorithm by giving an example of a data set. Also **define a policy** to select the number of processes.

The sequential algorithm for finding prime numbers is as follows.

1. Create an array of booleans and set them all to true at first. (true = prime)

2. Set array element 1 to false. Now 2 is prime.

3. Set the values whose index in the array is a multiple of the last prime found to false.

4. The next index where the array holds the value true is the next prime.

5. Repeat steps 3 and 4 until the last prime found is greater than the square root of the largest number in the array.

Question 5 (6 marks; 10 minutes)

Explain the limitation of the Amdahl's law and the effects of each parameter in the Amdahl's law

Question 6 (12 marks; 20 minutes)

From Amdahl's Law, find out the speed up if the scenario as follows.

1) Find the speedup when there are 4 processors and 30% parallelizable code

2) Find the speedup when there are 4 processors and 90% parallelizable code

3) Find the speedup when there are 32 processors and 30% parallelizable code

4) Find the speedup when there are 32 processors and 90% parallelizable code

5) Find the speedup when there are 128 processors and 30% parallelizable code

6) Find the speedup when there are 128 processors and 90% parallelizable code

Question 7 (7 marks; 10 minutes)

Explain Virtualization in Grid Computing in details.

Question 8 (6 marks; 10 minutes)

Compare MPI and OpenMp in terms of architecture, methods, usage and tradeoffs.

----End of Examination----

Pichaya Tandayya Lecturer

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