

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester 2

Academic Year: 2007-2008

Date: 25 December 2007

Time: 9.00 - 12.00 (3 hours)

Subject Number: 240-573

Room: R200

Subject Title: Special Topic in Computer System Design Engineering II (Parallel Computing)

Exam Duration: 3 hours

This paper has 13 pages, 7 questions and 130 marks (25%).

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.
- Attempt all questions in English.
- 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.

Question 1

(43 marks; 70 minutes)

- a) What are the differences between *parallel computing* and *serial computing*?
(4 marks)

Parallel computing	Serial computing

- b) What are the differences between *communication* and *synchronization*?
(4 marks)

Communication	Synchronization

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- f) In case of granularity, tell the **differences** between *fine grain* and *coarse grain* and their **effects** to *load balancing* and *computing performance*. (4 marks)

Fine grain	Coarse grain

- g) Compare two ways of partitioning: *domain decomposition* and *functional decomposition*. (4 marks)

Domain decomposition	Functional decomposition

- h) What are factors that contribute to *parallel overhead*? (2 marks)

l) What are factors that contribute to *scalability*? (2 marks)

m) What are the characteristics of *computational problems*? (2 marks)

n) What are the differences between *Uniform Memory Access (UMA)* and *Non-Uniform Memory Access (NUMA)*? (4 marks)

UMA	NUMA

c) Message Passing Model

(2 marks)

d) Data Parallel Model?

(2 marks)

Question 3

(12 marks; 15 minutes)

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

a) 2 processors and 60% parallelizable code

b) 2 processors and 90% parallelizable code

c) 10 processors and 60% parallelizable code

d) 10 processors and 90% parallelizable code

e) 100 processors and 60% parallelizable code

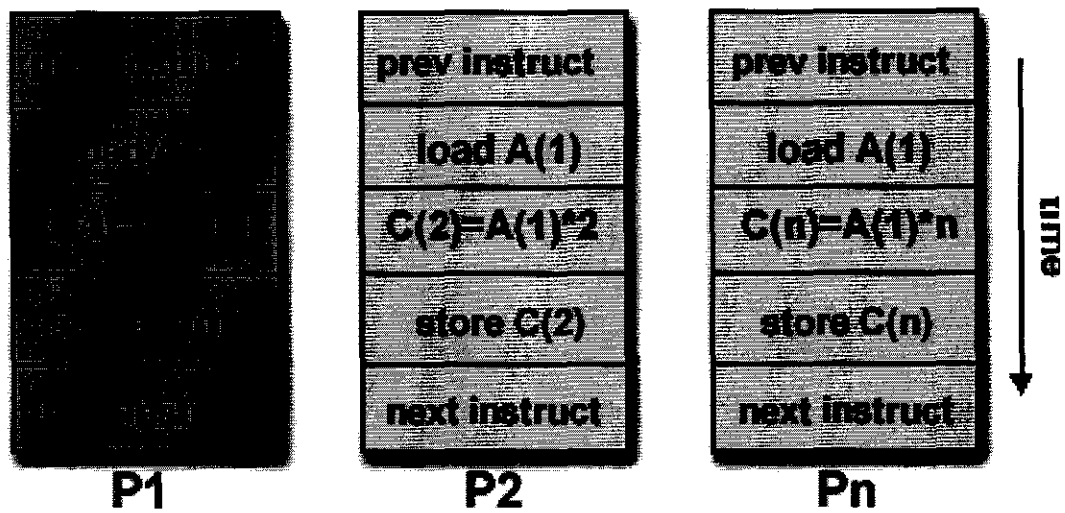
f) 100 processors and 90% parallelizable code

Question 4

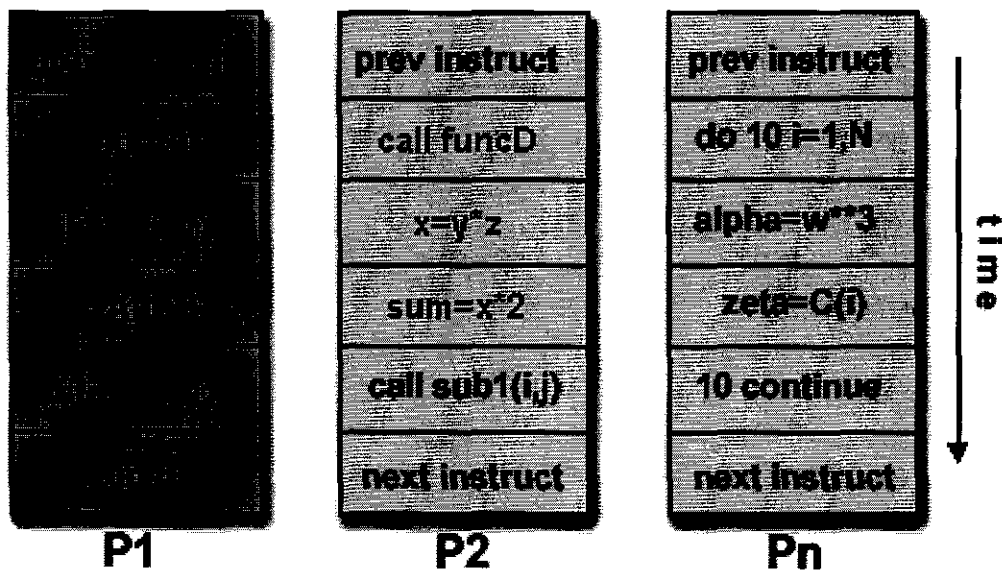
(8 marks; 10 minutes)

From the following pictures, tell which falls into which Flynn's classification..

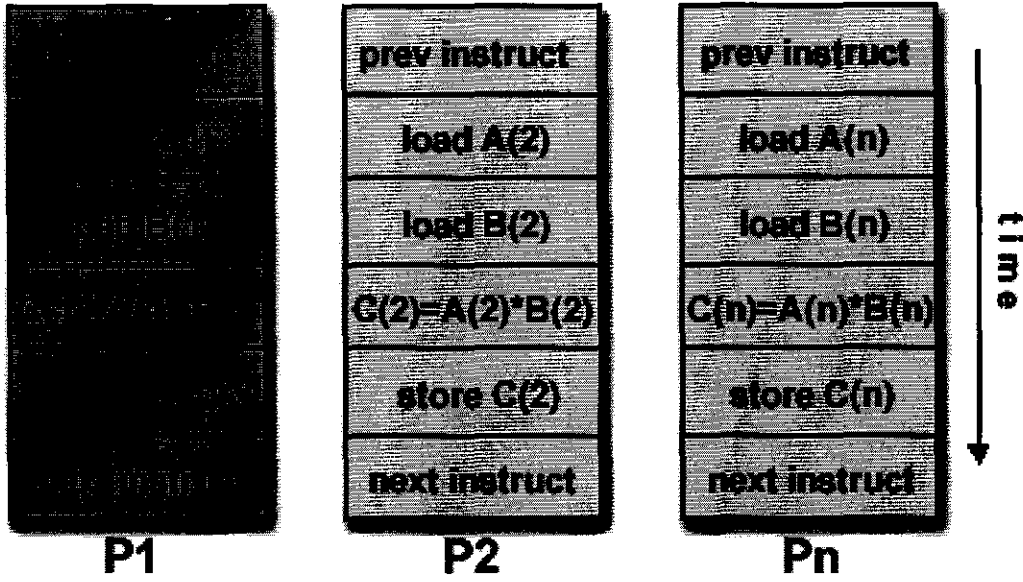
a)



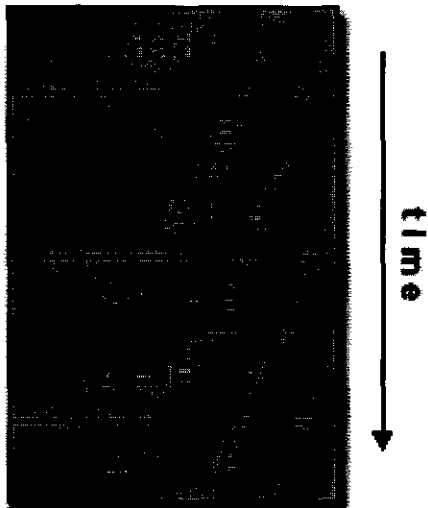
b)



c)



d)



Question 5

(10 marks; 15 minutes)

What are the **differences** between and the **advantages** and **disadvantages** of *Shared Memory* and *Distributed Memory* architectures?

Shared Memory	Distributed Memory

Question 6

(10 marks; 10 minutes)

Tell whether the following equations non-parallelizable. Also show how to decompose the parts of the equations.

a) $G(i) = G(i - 1) + G(i - 2)$

b) $H(a) = A(a) + B(a)$

c) $A(J+1) = A(J) * 4.0 + X(i) * W(i)$

d) $F(n) = F(n-1) * n$ if $n > 0$ and $= 1$ if $n = 0$

e) $F(x,y,z) = (\text{square root of } ((x+y)^3 - (x-z)^2)) / xy$

Question 7

(35 marks; 40 minutes)

Choose **only one** of the following algorithms to write parallel pseudo code using the MPI operations which might speed up the execution.

a) For $i = 1$ to 10

Do

$F(i) = \text{Summation of } (a(i) + b(i)^3)^k$ when k varies from 1 to 5

b) For $i = 1$ to 10

Do

$F(i) = \text{Square root of } (((x(i)+y(i))^3 - (x(i) + z(i))^2)/yz)$
