CHUKA UNIVERSITY
UNIVERSITY EXAMINATIONS
COSC 822 DISTRIBUTED COMPUTING ARCHTECTURES

Instructions: Answer Question One and any other Two Questions.

QUESTION ONE (30 MARKS) COMPULSORY

a) Discuss the following terms: (10 marks)

    i) Task.
    ii) Pipelining.
    iii) Shared Memory.
    iv) Symmetric Multi-Processor (SMP).
    v) Distributed Memory.

b) What is the difference between SPMD and SIMD?   (4 marks)

c) Explain four application areas of parallel systems.   (4 marks)

d) Differentiate between serial computation and parallel computation   (8 marks)

e) What is RPC? And how does it work.   (4 marks)

SECTION B 30 MARKS: Attempt any two questions

QUESTION TWO: 15 MARKS

a) Using suitable examples explain the Flynn's taxonomy.   (4 marks)
b) A programmer has parallelized 99% of a program, but there is no value in increasing the problem size, i.e., the program will always be run with the same problem size regardless of the number of processors or cores used. What is the expected speedup on 20 processors? Show your work.   (4 marks)
c) Given the following sequential code:

```
for i:=1 to 10 do
    b_i = 0
    for j:=1 to 10 do
        b_i = b_i + a_ij;
    endfor
endfor
```

Assume a parallel computer with 10 processors is available, write a pseudocode (with a diagram if necessary) to show

    i) How the above sequential code can be parallelized via concurrent data parallel computation.   (4 marks)
    ii) How the above sequential code can be parallelized via pipelined data parallel computation.   (3 marks)

QUESTION THREE: 15 MARKS

a) Current computers may combine different levels of parallelism. Describe three levels of parallelism. (6 marks)

b) Explain how the testing and debugging of programs is affected by whether the programs are parallel or distributed. (4 marks)

c)   i)   Briefly explain task granularity (2 marks)

    ii) What is the difference between Coarse-grain parallelism and fine- grain

       parallelism (3 marks)

QUESTION FOUR: 15 MARKS

a) Discuss what "Degree of Parallelism" is. (2 marks)
b) Describe synchronization mechanisms that can be used in shared memory parallel programs and synchronization mechanisms that are suitable for message passing parallel programs. (4 marks)
c) Describe the way a pipelined computer architecture obtains parallel operation. (4 marks)
d) A programmer has parallelized a program such that s, the amount of time the program spends in serial code, is 0.01. Moreover, the problem size can expand as the number of processors increases. What is the expected speedup on 20 processors? Show your work. (5 marks)

QUESTION FIVE: 15 MARKS

a) Describe the relationship if any between parallel systems and distributed systems. (3 marks)
b) Describe the Message Passing programming paradigm such as appears in MPI programs. What kinds of computer systems suit it? (4 marks)
c) Explain how the layout of data in memory can affect the performance of parallel programs sharing memory. (4 marks)
d) Describe the Shared Memory programming paradigm. What kinds of computer systems suit it? (4 marks)