

Arab Academy For Science and Technology & Maritime Transport
College of Engineering & Technology
Computer Engineering Department

EXAMINATION PAPER – Final

Course Title: Distributed and Parallel Systems

Course Code: CC755

Date: Fri. May, 27-2015

Lecturer: Dr. Manal Helal

Time allowed: 2 days

Start Time: 08:00 a.m.

Student's name:

Reg.# :

Question #	Marks	
	Actual	Available
Theory		10
MPI		8
Web Services		7
Hadoop		5
Total		30
Lecturer	Name : Dr. Manal Helal	
	Signature :	
	Date:	

MPC6/1-1

Theory:**[10 points]**

- 1) Explain what execution paths are for i) threads and for ii) processes? How they are created, managed in different ways, and the states they go through.
- 2) Explain the various methods of synchronisation between Threads in any programming language, giving example code and applications.
- 3) Explain the various algorithms to achieve mutual exclusion synchronisation in a distributed environment.
- 4) Give examples for cases when physical clock synchronisation are required, and when logical clocks are required. Explain the difference between scalar and vector logical clocks.
- 5) Consider a simple scenario in which there are five nodes A, B, C, D, and E. Use a sequence of figures to illustrate and explain the message sequences and coordination between these nodes when (i) node A acts as a central coordinator for a shared memory resources (that all five nodes can use) and both nodes B and C almost at the same time decides that they want to write to the resource, (ii) the bully algorithm is used to elect a new coordinator when node A crash.
- 6) How large must a k-fault tolerant group be?
- 7) What is the major problem of using RPCs in a wide-area network. Describe solutions to make this problem less severe.

MPI:**[8 points]**

8) Use MPI to implement a *Factman game*. The game GUI and logic is implemented in java and available on moodle, in the final exam section. Players take turns choosing from a list of numbers. They get the number added to their score, but the other player get the sum of the factors. The number and all factors are removed from the list and the players must choose from the remaining numbers on all subsequent rounds. When the list is empty, the player with the higher score wins.

The program is implemented for two players. Change it such that the number of players to be the number of processes in the mpirun command. Process 0 can be the coordinator for the game logic and controls how clients display the GUI (or command line output) and take turns, and chooses the upper bound of the list. Players processes coordinate

Web Services:**[7 points]**

9) Rewrite the compute loan program using web services. You can compute a loan payment for a loan with the specified amount, number of years, and annual interest rate. Use the Loan.java program available on moodle. Write a Web service with two remote methods for computing monthly payment and total payment. Write a client program that prompts the user to enter loan amount, number of years, and annual interest rate.

Hadoop:**[5 points]**

10) Discuss how Hadoop implements fault tolerance, consistency, synchronisation, and provide different forms of transparency and scalability.