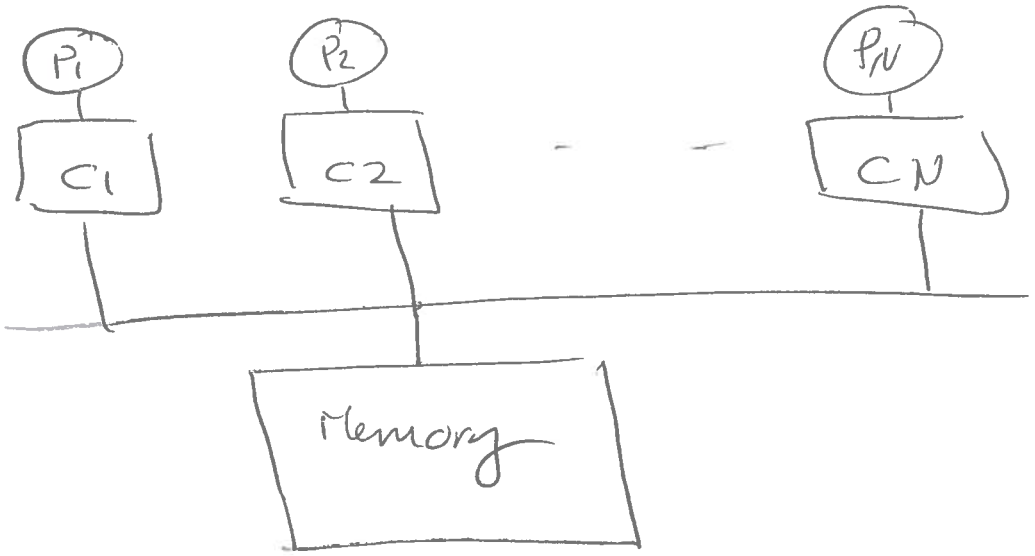
EE8218 Final Exam , Dec 15, 2015

EHE637 '12-2(00

Name_____

Q1-(10 marks)
Q1-A-Draw the block diagram for the shared memory multiprocessor system



6

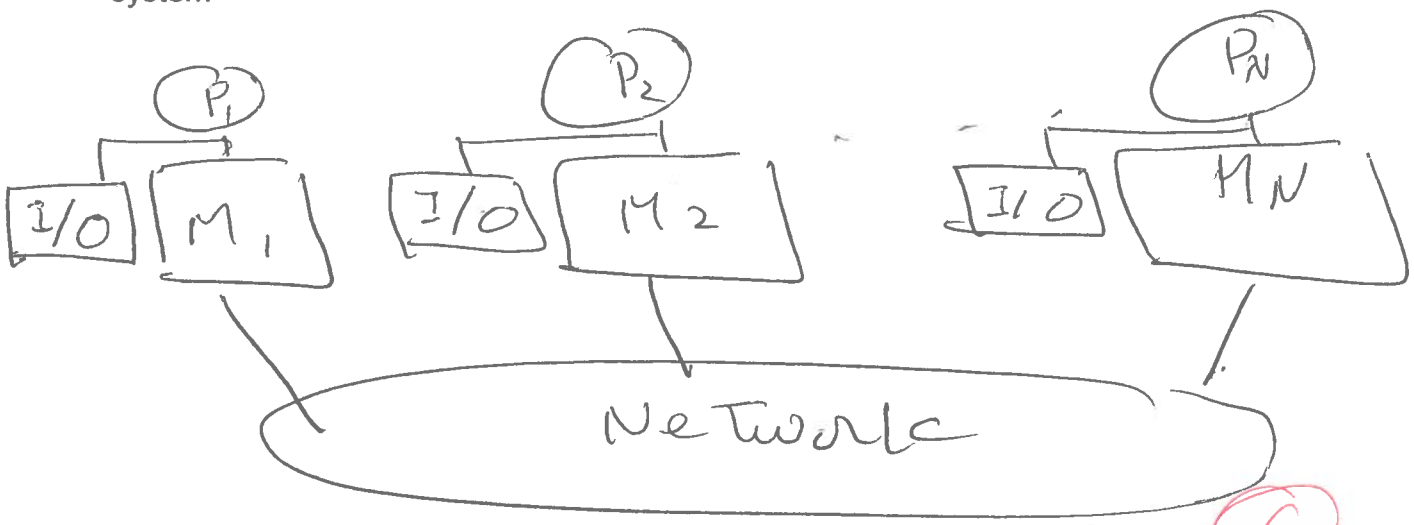
Q-1-B - Explain and list the factors that limit the performance and scalability of this system

1- Synchronization to access shared variables
2- Waiting time to Acquire the bus
3- cache miss rate - Invalidation, False sharing

4

Q2-(10 marks)

Q2-A-Draw the block diagram for message passing Distributed multiprocessor system



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Q-1-B- Explain and list the factors that limit the performance and scalability of this system

1- cost of communication

2- Network Topology

3- software overhead To SEND/RECEIVE messages

4

Q3-(20 Marks)

Q3-A-List the different steps to write an efficient parallel code

1- Decomposition to independent Tasks
2- Assignment of Tasks to multiple processes
3- orchestration
4- Mapping of processes to physical processors

10

Q3-B-Give the objectives in each step

1- Decomposition: as many independent tasks as possible (Algorithm)
2- Assignment: Load balance between diff. processes, all processes start at same time
3- orchestration: reduce cost of synchronization & communication
4- Mapping: no procan migration, map data used by procan close to it,

10

Q4-(60 marks)

Compare the scalability of shared memory and distributed memory system to a sigle processor by constructing a simple analytical models and assume the following:

-Application is equation solver 1000X1000 elements and each element is 32 bits and number of processors 100.

-Each computation per element is 50 instructions, and each instruction average time is 1 ns.

-Computation takes 100 times to converge

-Cost of synchronization 50 instructions per shared element

-Cost of communication= 40 us latency and Bandwidth is 200 Mbps assuming 10% of communication cost could be overlapped with computation.

1- single processor Time $= N^2 * 50 * 1ns \times 100$ (20)

$= 1000^2 \times 50 \times 10^{-9} \times 100 = 5s$

2- Shred Memory $= \frac{5s}{100} + 2N * 50 \times 1ns \times 100$

$= .05 + 2000 \times 50 \times 100 \times 10^{-9}$

$= .06s$ (20)

scalibility $= \frac{500}{6} = 83$

3- MPI $= \frac{5s}{100} + (40 \times 10^{-6} + \frac{2N \times 32}{200 \times 10^6}) .9 \times 100)$

$= .05 + (\frac{36}{10000} + \frac{2 \times 1000 \times 32}{200} \times 10^{-6} \times .9 \times 100$

$= .05 + (\frac{36}{10000} + 288 \times 10^{-3})$

$= .05 + .032 = .082$

$= \frac{500}{8.2} \approx 62$ (20)