

NAME \_\_\_\_\_

Problem 1

Consider a 5-dimensional hypercube.

- a) How many 4 dimensional subcubes are available in such a hypercube. List them.
- b) How many fault-free 4-dimensional subcubes are available if the link connecting node 11011 and node 10011 is broken? List them.
- c) How many fault-free 4-dimensional subcubes are available if in addition to the above link, nodes 11010 and 01000 are faulty. List them.

Problem 2

a. Using couple of sentences define the following

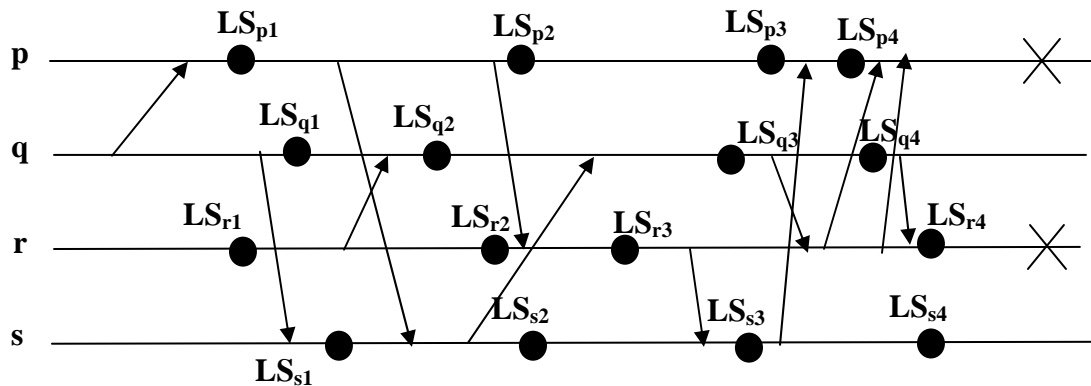
- I. Basic idea of checkpointing?
- II. Basic idea of backward recovery?
- III. Basic idea of forward recovery?
- IV. Orphan process

b. Consider the following figure in which 4 processes (p, q, r, and s) execute concurrently and exchange information by message passing. Consider the following global states

- I.  $GS_1 = \{LS_{p1}, LS_{q1}, LS_{r1}, LS_{s1}\}$
- II.  $GS_2 = \{LS_{p2}, LS_{q2}, LS_{r2}, LS_{s2}\}$
- III.  $GS_3 = \{LS_{p3}, LS_{q3}, LS_{r3}, LS_{s3}\}$
- IV.  $GS_4 = \{LS_{p4}, LS_{q4}, LS_{r4}, LS_{s4}\}$

Discuss whether each of the indicated global state is a consistent or inconsistent global state.

c. Construct a dependency graph and determine the recovery line for the indicated faults.



### Problem 3

Read the following papers and write a summary (maximum length: one page double spaced) for each paper.

- G. Candea, A.B. Brown, A. Fox, D. Patterson, "Recovery-Oriented Computing: Building Multitier Dependability," IEEE Computer, Vol. 37, No. 11, p p. 60-67, November 2004. ([PDF](#))
- J.O. Kephart, D.M. Chess, "The Vision of Autonomic Computing," IEEE Computer, Vol. 36, No. 1, pp. 41 - 50, January 2003. ([PDF](#))

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