Name ______________________

Multistage Interconnection Networks

EE 7700-3

Final Examination

11 December 1992, 15:00-17:00 C.S.T.

Open Papers, Open Notes

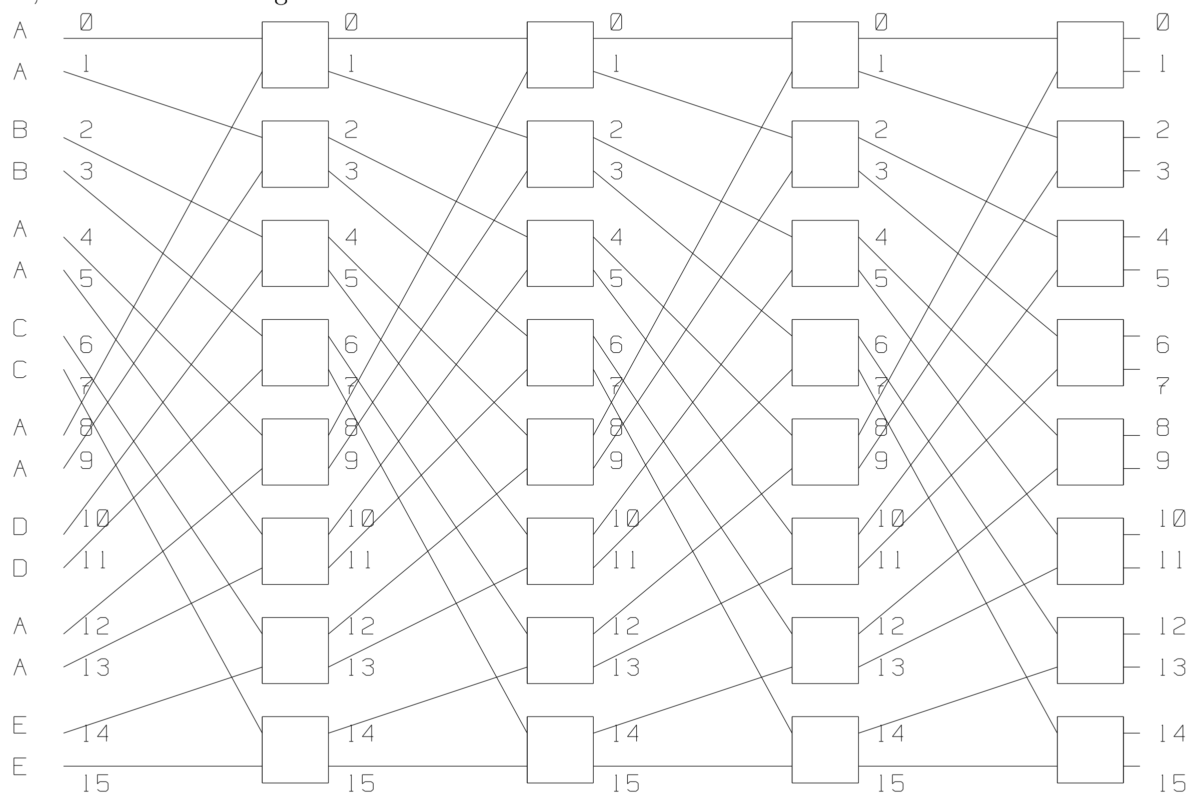
Modified for later semesters.

Problem 1	______	(25 pts)
Problem 2	______	(25 pts)
Problem 3	______	(25 pts)
Problem 4	______	(25 pts)
Exam Total	______	(100 pts)

Alias* ______________________

* Enter an alias only if you want your alias changed.

Problem 1: The omega network below is to be partitioned into five smaller networks, A, B, C, D, and E; as shown in the figure below.



(a) Show the J set(s) to accomplish this using J partitioning. (8pts)

(b) Let the X permutation(s) be $S_{1,1}$. Show which smaller network is connected to each output. (8pts)

(c) Show the permutation that affects each cell. Label the Y permutations Y_{A}, Y_{B}, Y_{C}, Y_{D}, and Y_{E}. If there is more than one X permutation, be sure to distinguish them (for example by calling them X, X', X'', etc.). (9pts)

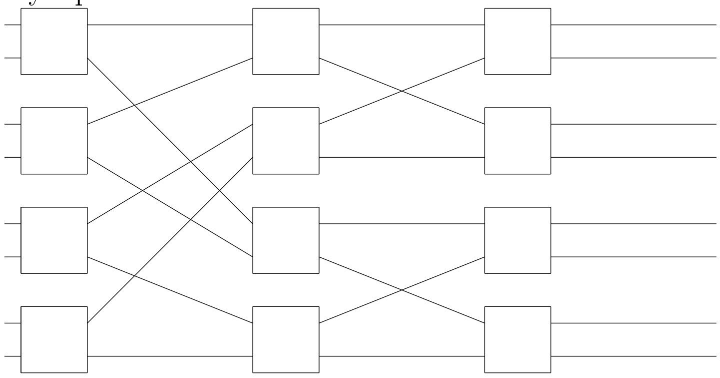
Problem 2: Consider the two networks below. Circle all that apply and *briefly* explain each choice (or lack thereof). (No credit will be given for correct but unexplained answers. Correct but long answers will not receive full credit.) (25pts)

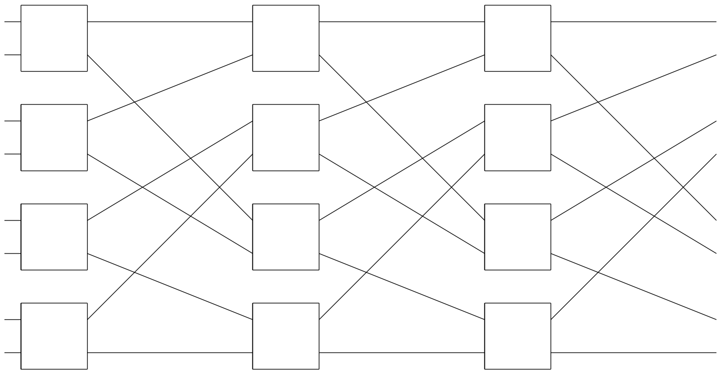
1 They are descriptively equivalent.

2 They are terminal equivalent.

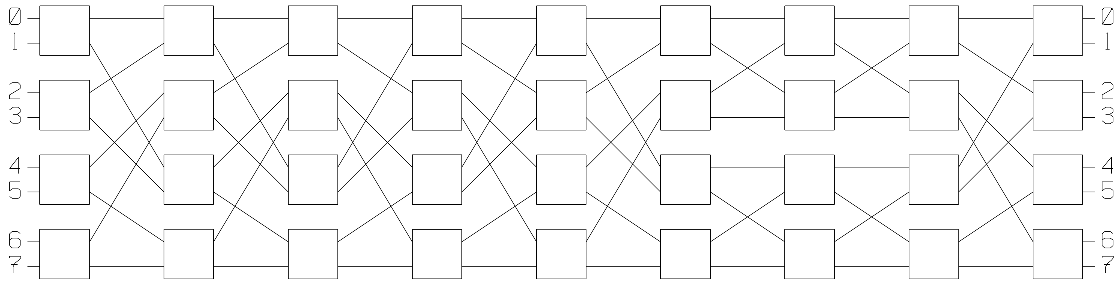
3 They are topologically equivalent.

4 They are functionally equivalent.





Problem 3: Below is a diagram of an 8-input pack/copy/permute generalized connector (the type described by Ofman).



(a) Identify the three different parts of the network (e.g., concentrator) (that is, show which stages belongs to which parts). Also, show which cells can broadcast (connect one input to two outputs). (7pts)

Consider the connection assignment

$$\{(0,6),(1,0),(1,2),(1,3),(3,1),(3,7),(6,4),(6,5)\}.$$

(b) Show the connection assignment to be realized by each part of the network. Show input and output terminal numbers on the diagram if they are not numbered sequentially. (10pts)

If you have completed (b), do (c), otherwise do (c′).

(c) Route the connection assignments from (b) in the generalized connector. (8pts)

(c′) Give an example of three connection assignments for an 8-input, 8-output network: a spreading connection assignment, a packing connection assignment, and an arbitrary permutation. (Although the identity permutation would be correct in all three cases, no credit will be given for it.) Route the arbitrary permutation on the Beneš network. (8pts)

Problem 4: Briefly answer each question below. Correct but lengthy answers will not receive full credit.

(a) For what values of x is the network $(3,(m,\frac{N}{m},x,\frac{N}{q}),(\frac{N}{m},x,\frac{N}{q},q),\mathrm{T},\mathrm{T})$ nonblocking? (Consider only positive values of N, m, and q, for which $N \equiv 0 \bmod m$ and $N \equiv 0 \bmod q$.) (5pts)

(b) Is a snooping cache coherence protocol suitable for a shared memory machine using a 2-ary n-cube? Explain. (5pts)

(c) An $m \times m$ cell uses a fast crossbar with queues at the outputs. Each input has (Bern(0.5), 1,Uni) traffic. Describe the traffic entering the queues. (5pts)

(d) Compute $|\Lambda_N|$. (If it's any help, $|\Lambda_N| = |\Upsilon_N|$). (10pts)

Have a good vacation!