Birla Institute of Technology and Science
II semester 2016-2017
MEL G641- CAD for IC Design
Comprehensive Examination (Open-Book)

16.05.2017 (AN) MM: 25 Duration: 1 Hr. 30 Min

Q1: Write a VHDL program to find a mod b, using suitable data types. **(2 M)**

Q2: In the blocks shown in Fig. 1, the operations are controlled by a control module. (A) Write the verilog code for the control module which generates (i) btot2=0;t2tob=0 when control = 00 (ii) btot2=1; t2tob=0 when control =01 (iii) btot2=0; t2tob=1 when control =11.
(B) Write the verilog code when this control module is interfaced with given circuit blocks which performs the following operations: (i) when btot2 is '1', it takes 16 bit bin as input and simultaneously saves it in latch t2, (ii) when t2tob is '1', it moves data from t2 to b. **(6 M)**

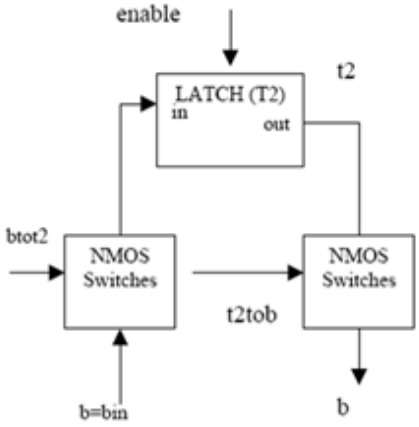

Figure 1

Q3: For the given verilog code if inputs are a=st1, ctrl1=st1, ctrl0=st0 then find the values of nets z1, z2, z3, z4. After 10 ns if ctrl1=st0, ctrl0=st1 then find values of nets z1, z2, z3, z4. **(2+1 M)**

```
module PQR_16_17 (a,ctrl0, ctrl1, z1,z2,z3,z4);
input a,ctrl0,ctrl1;
output z1,z2,z3,z4;
trireg (large) z1,z2;
tri0 z3,z4;

rcmos rc2 (z4,z3,ctrl1,ctrl0);
nmos rn2 (z4,z3,ctrl1);
rnmos rn1 (z3,z1,ctrl1);
rpmos rp1 (z3,z2,ctrl0);
notif0 n1 (z2,z1,ctrl0);
rcmos rc1 (z1,a,ctrl1,ctrl0);
endmodule
```

Q4: Use Kernighan-Lin algorithm on the bipartite graph shown if Fig.2 to reduce final cut size. Show all steps in the problem and gain table. Draw optimum bipartite graph and also find final cut-size.
(In case of tie, choose the **topmost** node in the list, e.g. if tie occurs between $(i, j)^{th}$ gain pair & $(i+x, j)^{th}$ gain pair then $(i, j)^{th}$ gain pair should be selected (where: x>1). **(8 M)**

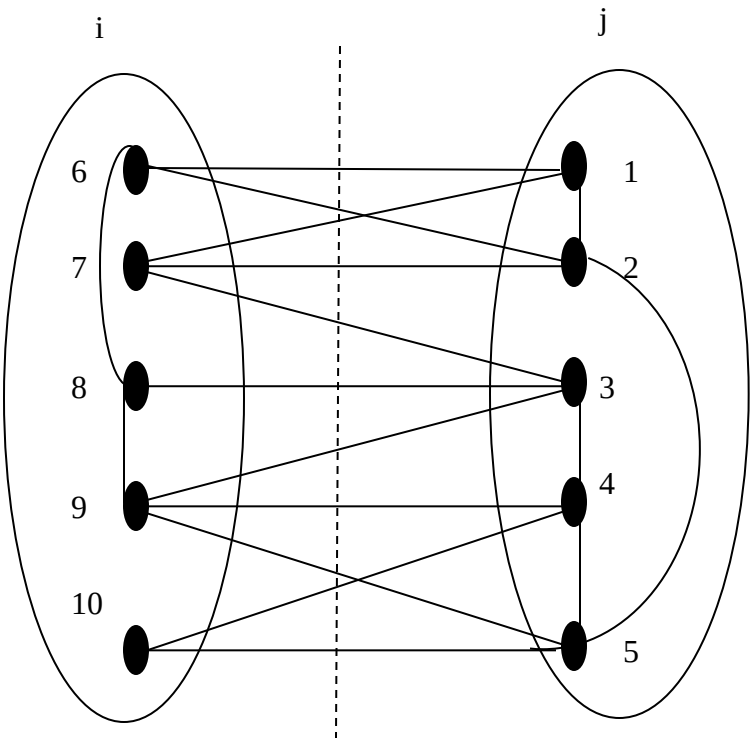

Figure 2

Q5: Apply the spanning tree, Steiner tree and source to sink connection algorithms on the grid graph model shown in Fig. 3 to find the minimum length of net connecting 'S' ad 'T'. (Where: S=Source, T=Target) **(3 M)**

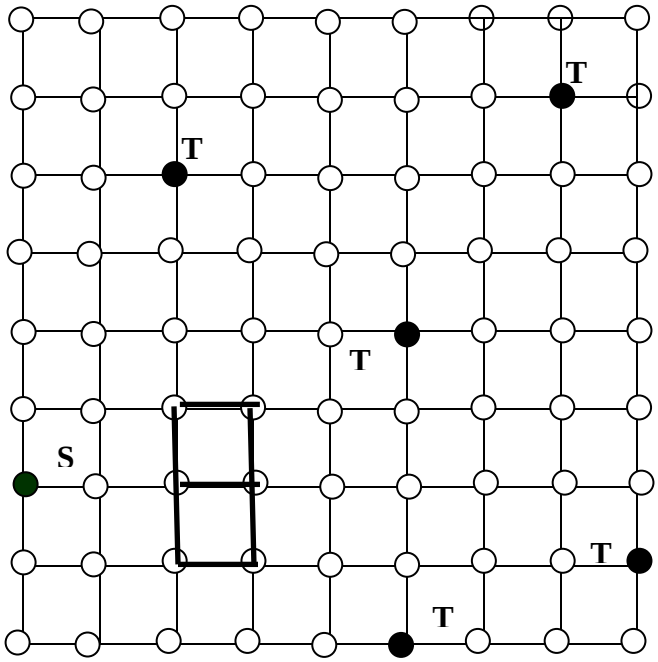

Figure 3

Q6: For the following given optimized equations, find scheduled sequence graph and determine the minimum number of resources required with minimum time steps. (Assume all operations takes single cycle). **(3 M)**

$X = (S - R)/(R - P);$

$Y = [(R - P) - Q] > T;$

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