Time 2Hr **Computer Organization and Architecture** MA31009 Autumn 2016

Instruction: There are 10 questions (3 marks each). Show complete rough work. Write final answer in a box. Write mistakes in the question/example also in the same box. No Calculator. No query.

1. d=M(a,b,c) when c=0 d=a else d=b. d=M(d,b,c) when c=1 d=b else d unchanged.
c=K(a,b): d=M(d,a,b) c=M(d,c,b) Here K(a,b) outputs 'a' when b:1 → 0. It is unchanged otherwise.
L(a,b): is similar When b:0 → 1 L(a,b) outputs 'a'. Output is unchanged otherwise.
r=M(L(p,u),K(q,u),u): When u:0 → 1 r=that 'q' when u:1 → 0. When u: 1 → 0 similar.
Let u is '0' during time t=0-100, 200-300, 400-500, 600-700, 800-900 'u' is '1' otherwise.
At time t=320 the output(r) is 3136. What is output(r) at time t=574 and 842?

time	0-70	70-120	120-260	260-350	350-382	382-780	780-790	790-810	810-915
p	1799	2826	3931	4123	5612	6782	7313	8524	9138
q	1134	2145	3136	4135	5423	6924	7783	8532	9169

2. A disk takes 100 units of time to complete a revolution. It takes unit time to move to adjacent track. There are 100 blocks on a track. To facilitate file transfer blocks on next track are shifted by one (1). At time t=0 the head is at block number 21740. We want to access blocks 24078 and 14042. How much time will it take? Example: At present head is at 20000. We want to access 22573, 23684 and 21213. It will take 221 time. Reason: At t=25 head is on 22500. At t=98 on 22573, 109 → 23673, 120 → 23684, 144 → 21236.

3. [56,7,14,-21,-175,28,35,105,189,T] realizes some Boolean expression for T=164. Write smallest value of T so that the same Boolean expression is realized. True=1 False=0
Example: [7,2,-1,8,7] realizes x(y+z')+w. Weights of x, y, z and w are 7, 2, -1 and 8 respectively.

4. An faulty 'AND' gate produces wrong output when input is (0,1). Design fault tolerant 'and' gate using minimum number of 'and' gates. Example: When wrong output is produced for inputs (0,1) and (1,0) then fault tolerant gate is and(and(x,y),and(x,y))

5. What is the output of following?

0	1	2	3	4	5	6	7	8	9
ib=8	mar=ib	mbr=[mar]	ib=12	mar=ib	[mar]=mbr	ib=27	p=ib	ib=70	ib=82

10	11	12	13	14	15	16	17	18
ib=19	q=ib	d=ib	p=ib	p=ib	ib=p*q	print(ib)	ib=0	pc=ib

6. $k_2k_1k_6k_4k_9k_0k_5k_3k_7k_8$=decoder(u) g=selector($a_1,a_5,a_6,a_7,a_0,a_8,a_4,a_6+a_7,a_2*a_5,a_3$,v). a_i=selector(a_i,g,k_i). Let initially a_0=29 a_1=42 a_2=79 a_3=91 a_4=37 a_5=60 a_6=29 a_7=37 a_8=82. Let "uv=48" is issued. What memory change will be made? Example: "uv=37" will make a_4=66.

7. float a,b,c; int x,y; a=5+1/3.0; x=22; b=a+x+y; c=a+(x+y); For which values of y b>c.
Example: a=10+1/3.0; x=17 when 37 ≤ y ≤ 100 b<c x=6 to 53 y=54-x to 117-x [24 bits float]

8. Design a circuit for (xz+yc+yz)(pq+rh+rq). Use earth, switches, and resistances 1, 10, 100 and 1000.

9. F(abcdefg)=pqr. It is the location of first 1 in abcdefg. When there is no '1' then it is 000. F(0000101)=101 F(0100110)=010 F(0000000)=000. F is designed using G(abc)=pq. G(010)=10 g(011)=10 G(101)=01. G(000)=00. Write missing (no if).

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xy=G(abc)
if xy ≠ 00 { p=0 qr=xy }
else
{ if (d=1) pqr=100
  else {xy=G(efg) missing }
}
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10. Let a..i be boolean variables. Let x, y and z be boolean expressions. x has d, e and f. y has f, g and h. z has d, h and i. The boolean expression K=(ab'+x)(bc'+y)(ca'+z) is found to be true for a=1 b=1 c=0 d=1 e=0 f=1 g=1 h=0 i=0. On the basis of this information give more solutions of K.
Example: L=(a+b+x)(a'+b'+y)(a'+b+z). L is true for a,b,c,d,e,h=1 and f,g=0.
Hence L is also true for (a=0 b=1 cdefghi=any) or (b=1 a,c,d,e,i=any h=1 f,g=0)

The end of question paper