Exam Solutions

March 2017

1. (a) constraint word_aligned{v_addr[1:0]==2'b00;}
   (b) constraint page_fix{v_addr[31:12]==20'd4096;}
2. (a) No, a finite state machine which would require to keep an *exact* count of the number of 0's or 1's cannot be made, since the number of states in such a machine cannot be bounded by a finite number. Consider cases where all 0's precede all 1's. The machine will have to keep an exact count of all the 0's, and therefore, such a machine cannot be made.
   (b) No, same reason as above. No pattern can be made to possibly reuse the old states.
   (c) No, same reason as above.
3. (a) Let $k = 0^*11^*0(1(101)^*0 + 00^*11^*0)^*1(101)^*1$
   $k(1k)^*0(0k(1k)^*0)^*$
   (b) 10110
   (c) One possible solution is shown in Fig. 1
4. CNF Clauses : z (z'+d+e) (z+d') (z+e') (d'+a) (d'+c) (d+a'+c') (c+s) (c'+s') (e'+b) (e'+s) (e+b'+s') Through Unit propagation, the following satisfying assignments can be found:
   (a) (a,b,s,c,d,e,z) = (1,X,0,1,1,0,1)
   (b) (a,b,s,c,d,e,z) = (X,1,1,0,0,1,1)
5. (a) No
   (b) Yes
   (c) No
   (d) Yes
   (e) No
   (f) Yes
   (g) No
   (h) No
6. Solution is shown in Fig. 2

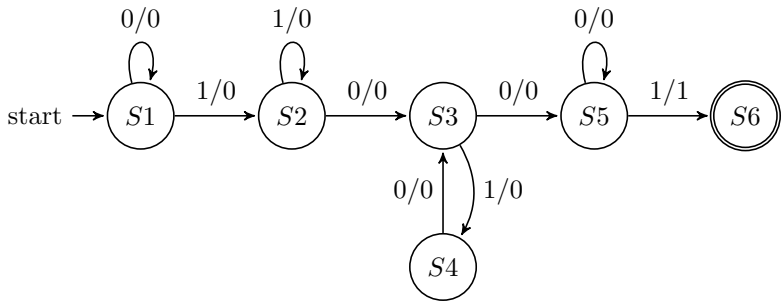

Figure 1: Q3(c)

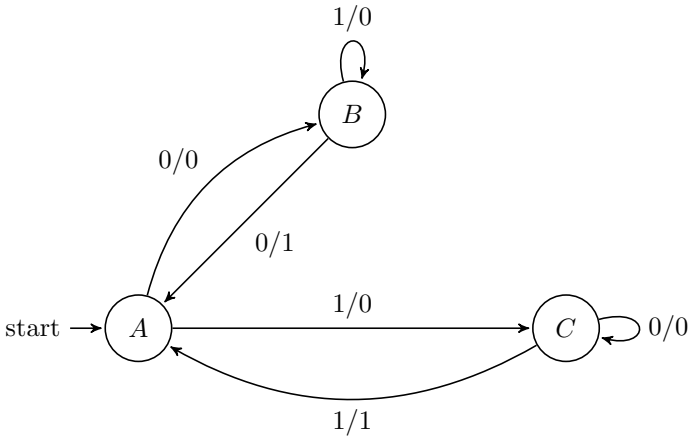

Figure 2: Q6