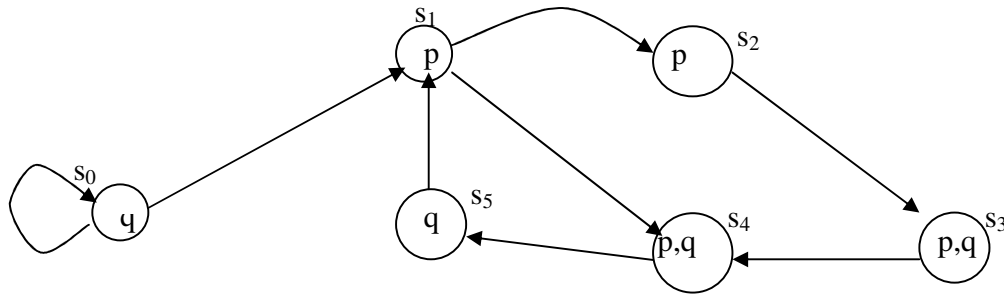
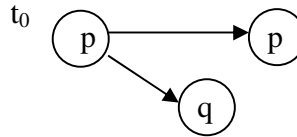
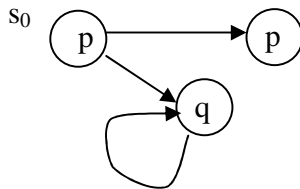


1. [2 points] Using the labelling algorithm, calculate the set of states of the following transition system satisfying the CTL formula $EFA[q \cup EX q]$.



2. [1 point] Give a CTL formula that satisfies s_0 but not t_0



3. [2 point] Exhibit a proof tree for deriving the final state of the following configuration

$$\langle x:=3; \text{ while } x<4 \text{ do } x:=x+1 \text{ od}, \sigma \rangle$$

where $\sigma(x) = 2$.

4. [2 point] Give a valid proof outline for the following Hoare triples:
 a) $\{ |b|= 2 \} a := b; a[1] := 2; a[2] := 3; b := a \{ b[2]=3 \}$
 b) $\{ |b|= 2 \} a := b; a[1] := 2; a[a[1]] := 3; b := a \{ b[2]=3 \}$
5. [2 points] Give a proof outline for the *partial* correctness of the following Hoare triple:

```

{ x ≥ 0 ∧ y > 0 }
q := 0;
r := x;
while r ≥ y do
  q := q+1;
  r := r-y;
od
{ q*y+r=x }
  
```

6. [1 point] Give a proof outline for the *total* correctness of the Hoare triple in exercise 5.

The final score is given by the sum of the points obtained.