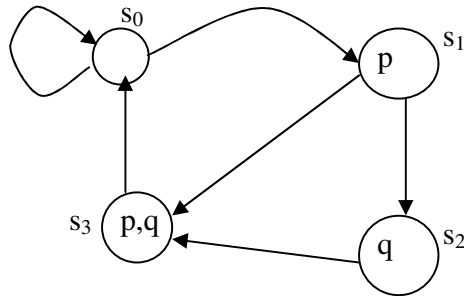


1. [2 points] Using the labelling algorithm, calculate the set of states of the following transition system satisfying the CTL formula $EF(p \wedge AX q)$.



2. [1 point] Give a model with a state s_0 that satisfies the CTL formula $EF\neg p$ but not $\neg AF p$.
3. [2 points] Exhibit a derivation of the final state of the configuration $\langle c, \sigma \rangle$, where $\sigma(x)=2$ and $\sigma(y)=4$ and c is the following command

```

while x≠y do
  if x<y then y:=y-x
  else x:=x-y
fi
do

```

4. Give a derivation of the following Hoare triples using the proof system for partial correctness:

a) [1 point] $\{x \neq 0 \wedge n > 0\}$ while $x \neq n$ do $x := x+1$ od $\{x = n+1\}$

b) [1 point] $\{x > 0\}$ while true do $x := x+1$ od $\{x \neq 0\}$

5. [1 point] Give a proof outline for the partial correctness of the following Hoare triple

$\{\text{true}\} x := y+5; \text{ if } x = 5 \text{ then } z := 5 \text{ else } z := x \text{ fi } \{z = y+5\}$

6. [2 points] Give a proof outline for the total correctness of the following Hoare triple:

```

{ 0 ≠ x }
y := 0;
z := 1;
while z ≠ x do
  y := y+n;
  z := z+1
od
{ y = n*x }

```

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