Q1:

$$(s0 \vee \neg ns1)(a \vee \neg ns1)(\neg s0 \vee \neg a \vee ns1) \quad (\neg a \vee \neg ns0)(a \vee ns0)$$

$$(\neg s1)(\neg s0)$$

$$(ns1)(\neg ns0)$$

See formula.

Formula has 0 satisfying assignments out of 32 possible (5 vars)

No, it cannot reach 10 from initial state 00 in one step

Q2:

var	value
$s0_0$	0
$s1_0$	0
$ns0_0$	1
$ns1_0$	0
a_0	0
$s0_1$	1
$s1_1$	0
$ns0_1$	0
$ns1_1$	1
a_1	1

$$(s0_0 \vee \neg ns1_0)(a_0 \vee \neg ns1_0)(\neg s0_0 \vee \neg a_0 \vee ns1_0) \quad (\neg a_0 \vee \neg ns0_0)(a_0 \vee ns0_0)$$

$$(s0_1 \vee \neg ns1_1)(a_1 \vee \neg ns1_1)(\neg s0_1 \vee \neg a_1 \vee ns1_1) \quad (\neg a_1 \vee \neg ns0_1)(a_1 \vee ns0_1)$$

$$(\neg ns1_0 \vee s1_1)(ns1_0 \vee \neg s1_1)$$

$$(\neg ns0_0 \vee s0_1)(ns0_0 \vee \neg s0_1)$$

$$(\neg s1_0)(\neg s0_0)$$

$$(ns1_1)(\neg ns0_1)$$

See formula. Subscript/color indicates which unrolling var is from

Formula has 1 satisfying assignment out of 1024 possible (10 vars)

Yes, it can reach 10 from initial state 00 in two steps.

Q3: Here is the solution when repeating Q3 using SAT solver.

p1.dimacs

```
p cnf 5 9
c
c  s0 = 1
c  s1 = 2
c ns0 = 3
c ns1 = 4
c   a = 5
c
c  transition relation
1 -4 0
5 -4 0
-1 -5 4 0
-5 -3 0
5 3 0
c   initial state:
-1 0
-2 0
c   final state target:
4 0
-3 0
```

```
-:---  p1.dimacs      All    L21
```

p2.dimacs

```
p cnf 10 18
c
c  s0_0 = 1
c  s1_0 = 2
c ns0_0 = 3
c ns1_0 = 4
c   a_0 = 5
c
c  s0_1 = 6
c  s1_1 = 7
c ns0_1 = 8
c ns1_1 = 9
c   a_1 = 10
c
c   1st transition relation
1 -4 0
5 -4 0
-1 -5 4 0
-5 -3 0
5 3 0
c   2nd transition relation:
6 -9 0
10 -9 0
-6 -10 9 0
-10 -8 0
10 8 0
c   initial state:
-1 0
-2 0
c   final state target:
9 0
-8 0
c   buffer clauses:
-4 7 0
4 -7 0
-3 6 0
3 -6 0
```

```
-:---  p2.dimacs      All    L3
```

~/examples

```
[14:24:29] ~/examples  $picosat p1.dimacs
s UNSATISFIABLE
[14:24:31] ~/examples  $picosat p2.dimacs
s SATISFIABLE
v -1 -2 3 -4 -5 6 -7 -8 9 10 0
[14:24:33] ~/examples  $
```

var	dimacs index	value
$s0_0$	1	0
$s1_0$	2	0
$ns0_0$	3	1
$ns1_0$	4	0
a_0	5	0
$s0_1$	6	1
$s1_1$	7	0
$ns0_1$	8	0
$ns1_1$	9	1
a_1	10	1