hw07_report_106062202

1. How I developed my finite state machine: (X stands for impossible situation)
    a. Move: Forward, next move:

Previous / Now	Wall at left	Wall at right	Wall ahead	No walls
Wall at left	Forward	X	Turn right	Turn left
Wall at right	X	Forward	X	Turn right
Wall ahead	X	X	X	X
No walls	Forward	Turn right	Turn right	Turn right

    b. Move: Left, next move:

Previous / Now	Wall at left	Wall at right	Wall ahead	No walls
Wall at left	X	X	Turn right	X
Wall at right	Forward	X	X	Turn left
Wall ahead	Turn right	Turn right	Turn right	X
No walls	Forward	X	X	forward

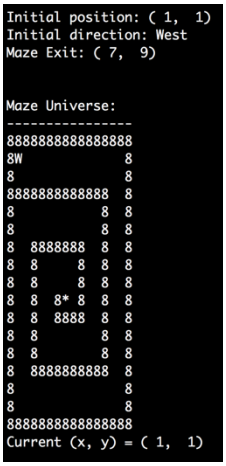
    c. Move: Right, next move:

Previous / Now	Wall at left	Wall at right	Wall ahead	No walls
Wall at left	X	Turn left	X	Turn left
Wall at right	X	X	Turn right	X
Wall ahead	Forward	X	Turn right	X
No walls	X	Turn left	X	forward

    d. Move: Halt, next move:

Now	Wall at left	Wall at right	Wall ahead	No walls
Next move	Forward	Turn right	Turn right	Forward

2. Results:
    a. my maze:



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[Step    1] Turn Right   Position ( 1,  1) North  LR=11   [Step   30] Move Forward Position (14, 15) South  LR=11  [Step   59] Move Forward Position ( 3,  4) East   LR=10
[Step    2] Turn Right   Position ( 1,  1) East   LR=10   [Step   31] Turn Right   Position (14, 15) West   LR=10  [Step   60] Move Forward Position ( 4,  4) East   LR=10
[Step    3] Move Forward Position ( 2,  1) East   LR=10   [Step   32] Move Forward Position (13, 15) West   LR=10  [Step   61] Move Forward Position ( 5,  4) East   LR=10
[Step    4] Move Forward Position ( 3,  1) East   LR=10   [Step   33] Move Forward Position (12, 15) West   LR=10  [Step   62] Move Forward Position ( 6,  4) East   LR=10
[Step    5] Move Forward Position ( 4,  1) East   LR=10   [Step   34] Move Forward Position (11, 15) West   LR=10  [Step   63] Move Forward Position ( 7,  4) East   LR=10
[Step    6] Move Forward Position ( 5,  1) East   LR=10   [Step   35] Move Forward Position (10, 15) West   LR=10  [Step   64] Move Forward Position ( 8,  4) East   LR=10
[Step    7] Move Forward Position ( 6,  1) East   LR=10   [Step   36] Move Forward Position ( 9, 15) West   LR=10  [Step   65] Move Forward Position ( 9,  4) East   LR=10
[Step    8] Move Forward Position ( 7,  1) East   LR=10   [Step   37] Move Forward Position ( 8, 15) West   LR=10  [Step   66] Move Forward Position (10,  4) East   LR=10
[Step    9] Move Forward Position ( 8,  1) East   LR=10   [Step   38] Move Forward Position ( 7, 15) West   LR=10  [Step   67] Move Forward Position (11,  4) East   LR=11
[Step   10] Move Forward Position ( 9,  1) East   LR=10   [Step   39] Move Forward Position ( 6, 15) West   LR=10  [Step   68] Turn Right   Position (11,  4) South  LR=10
[Step   11] Move Forward Position (10,  1) East   LR=10   [Step   40] Move Forward Position ( 5, 15) West   LR=10  [Step   69] Move Forward Position (11,  5) South  LR=10
[Step   12] Move Forward Position (11,  1) East   LR=10   [Step   41] Move Forward Position ( 4, 15) West   LR=10  [Step   70] Move Forward Position (11,  6) South  LR=10
[Step   13] Move Forward Position (12,  1) East   LR=10   [Step   42] Move Forward Position ( 3, 15) West   LR=10  [Step   71] Move Forward Position (11,  7) South  LR=10
[Step   14] Move Forward Position (13,  1) East   LR=10   [Step   43] Move Forward Position ( 2, 15) West   LR=10  [Step   72] Move Forward Position (11,  8) South  LR=10
[Step   15] Move Forward Position (14,  1) East   LR=11   [Step   44] Move Forward Position ( 1, 15) West   LR=11  [Step   73] Move Forward Position (11,  9) South  LR=10
[Step   16] Turn Right   Position (14,  1) South  LR=10   [Step   45] Turn Right   Position ( 1, 15) North  LR=10  [Step   74] Move Forward Position (11, 10) South  LR=10
[Step   17] Move Forward Position (14,  2) South  LR=10   [Step   46] Move Forward Position ( 1, 14) North  LR=10  [Step   75] Move Forward Position (11, 11) South  LR=10
[Step   18] Move Forward Position (14,  3) South  LR=10   [Step   47] Move Forward Position ( 1, 13) North  LR=10  [Step   76] Move Forward Position (11, 12) South  LR=11
[Step   19] Move Forward Position (14,  4) South  LR=10   [Step   48] Move Forward Position ( 1, 12) North  LR=10  [Step   77] Turn Right   Position (11, 12) West   LR=10
[Step   20] Move Forward Position (14,  5) South  LR=10   [Step   49] Move Forward Position ( 1, 11) North  LR=10  [Step   78] Move Forward Position (10, 12) West   LR=10
[Step   21] Move Forward Position (14,  6) South  LR=10   [Step   50] Move Forward Position ( 1, 10) North  LR=10  [Step   79] Move Forward Position ( 9, 12) West   LR=10
[Step   22] Move Forward Position (14,  7) South  LR=10   [Step   51] Move Forward Position ( 1,  9) North  LR=10  [Step   80] Move Forward Position ( 8, 12) West   LR=10
[Step   23] Move Forward Position (14,  8) South  LR=10   [Step   52] Move Forward Position ( 1,  8) North  LR=10  [Step   81] Move Forward Position ( 7, 12) West   LR=10
[Step   24] Move Forward Position (14,  9) South  LR=10   [Step   53] Move Forward Position ( 1,  7) North  LR=10  [Step   82] Move Forward Position ( 6, 12) West   LR=10
[Step   25] Move Forward Position (14, 10) South  LR=10   [Step   54] Move Forward Position ( 1,  6) North  LR=10  [Step   83] Move Forward Position ( 5, 12) West   LR=10
[Step   26] Move Forward Position (14, 11) South  LR=10   [Step   55] Move Forward Position ( 1,  5) North  LR=10  [Step   84] Move Forward Position ( 4, 12) West   LR=11
[Step   27] Move Forward Position (14, 12) South  LR=10   [Step   56] Move Forward Position ( 1,  4) North  LR=11  [Step   85] Turn Right   Position ( 4, 12) North  LR=10
[Step   28] Move Forward Position (14, 13) South  LR=10   [Step   57] Turn Right   Position ( 1,  4) East   LR=10  [Step   86] Move Forward Position ( 4, 11) North  LR=10
[Step   29] Move Forward Position (14, 14) South  LR=10   [Step   58] Move Forward Position ( 2,  4) East   LR=10  [Step   87] Move Forward Position ( 4, 10) North  LR=10
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[Step   82] Move Forward Position ( 6, 12) West   LR=10
[Step   83] Move Forward Position ( 5, 12) West   LR=10
[Step   84] Move Forward Position ( 4, 12) West   LR=11
[Step   85] Turn Right   Position ( 4, 12) North  LR=10
[Step   86] Move Forward Position ( 4, 11) North  LR=10
[Step   87] Move Forward Position ( 4, 10) North  LR=10
[Step   88] Move Forward Position ( 4,  9) North  LR=10
[Step   89] Move Forward Position ( 4,  8) North  LR=10
[Step   90] Move Forward Position ( 4,  7) North  LR=11
[Step   91] Turn Right   Position ( 4,  7) East   LR=10
[Step   92] Move Forward Position ( 5,  7) East   LR=10
[Step   93] Move Forward Position ( 6,  7) East   LR=10
[Step   94] Move Forward Position ( 7,  7) East   LR=10
[Step   95] Move Forward Position ( 8,  7) East   LR=11
[Step   96] Turn Right   Position ( 8,  7) South  LR=10
[Step   97] Move Forward Position ( 8,  8) South  LR=10
[Step   98] Move Forward Position ( 8,  9) South  LR=11
[Step   99] Turn Right   Position ( 8,  9) West   LR=10
[Step  100] Move Forward Position ( 7,  9) West   LR=00  <You Made It!!>

<<< Total steps used:         100 >>>
>>> MAZE ESCAPED!!!

>>> Congratulations! Escape at time [               10400]

Simulation complete via $finish(1) at time 1090 NS + 0
./AntVengers.v:66       $finish;
ncsim> exit
[dld063@ic21 ~/hw07]$
```

b. maze07x06:

```
Initial position: ( 1,  1)
Initial direction: West
Maze Exit: ( 6,  2)


Maze Universe:
-------
8888888
8W 8  8
8  8  *
8     8
8     8
8888888
Current (x, y) = ( 1,  1)
[Step    1] Turn Right   Position ( 1,  1) North  LR=11
[Step    2] Turn Right   Position ( 1,  1) East   LR=10
[Step    3] Move Forward Position ( 2,  1) East   LR=11
[Step    4] Turn Right   Position ( 2,  1) South  LR=10
[Step    5] Move Forward Position ( 2,  2) South  LR=10
[Step    6] Move Forward Position ( 2,  3) South  LR=00
[Step    7] Turn Left    Position ( 2,  3) East   LR=00
[Step    8] Move Forward Position ( 3,  3) East   LR=10
[Step    9] Move Forward Position ( 4,  3) East   LR=00
[Step   10] Turn Left    Position ( 4,  3) North  LR=00
[Step   11] Move Forward Position ( 4,  2) North  LR=10
[Step   12] Move Forward Position ( 4,  1) North  LR=11
[Step   13] Turn Right   Position ( 4,  1) East   LR=10
[Step   14] Move Forward Position ( 5,  1) East   LR=11
[Step   15] Turn Right   Position ( 5,  1) South  LR=10

8W 8  8
8  8  *
8     8
8     8
8888888
Current (x, y) = ( 1,  1)
[Step    1] Turn Right   Position ( 1,  1) North  LR=11
[Step    2] Turn Right   Position ( 1,  1) East   LR=10
[Step    3] Move Forward Position ( 2,  1) East   LR=11
[Step    4] Turn Right   Position ( 2,  1) South  LR=10
[Step    5] Move Forward Position ( 2,  2) South  LR=10
[Step    6] Move Forward Position ( 2,  3) South  LR=00
[Step    7] Turn Left    Position ( 2,  3) East   LR=00
[Step    8] Move Forward Position ( 3,  3) East   LR=10
[Step    9] Move Forward Position ( 4,  3) East   LR=00
[Step   10] Turn Left    Position ( 4,  3) North  LR=00
[Step   11] Move Forward Position ( 4,  2) North  LR=10
[Step   12] Move Forward Position ( 4,  1) North  LR=11
[Step   13] Turn Right   Position ( 4,  1) East   LR=10
[Step   14] Move Forward Position ( 5,  1) East   LR=11
[Step   15] Turn Right   Position ( 5,  1) South  LR=10
[Step   16] Move Forward Position ( 5,  2) South  LR=00
[Step   17] Turn Left    Position ( 5,  2) East   LR=00
[Step   18] Move Forward Position ( 6,  2) East   LR=00  <You Made It!!>

<<< Total steps used:          18 >>>
>>> MAZE ESCAPED!!!

>>> Congratulations! Escape at time [               2200]
```

c. maze_15x15

```
Initial direction: South
Maze Exit: ( 6,  0)


Maze Universe:
--------------
888888*88888888
8        8    8
8        8    8
8  8     88   8
8  8888      88
8     8       8
8     8       8
8888888   S 888
8            88
8             8
8     88888   8
8        8    8
8  8     8    8
8  8     8    8
888888888888888
Current (x, y) = (10,  7)
[Step    1] Move Forward Position (10,  8) South  LR=00
[Step    2] Move Forward Position (10,  9) South  LR=11
[Step    3] Turn Right   Position (10,  9) West   LR=10
[Step    4] Move Forward Position ( 9,  9) West   LR=10
[Step    5] Move Forward Position ( 8,  9) West   LR=10
[Step    6] Move Forward Position ( 7,  9) West   LR=10
[Step    7] Move Forward Position ( 6,  9) West   LR=10
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[Step    8] Move Forward Position ( 5,  9) West   LR=00
[Step    9] Turn Left    Position ( 5,  9) South  LR=00
[Step   10] Move Forward Position ( 5, 10) South  LR=10
[Step   11] Move Forward Position ( 5, 11) South  LR=00
[Step   12] Turn Left    Position ( 5, 11) East   LR=00
[Step   13] Move Forward Position ( 6, 11) East   LR=10
[Step   14] Move Forward Position ( 7, 11) East   LR=10
[Step   15] Move Forward Position ( 8, 11) East   LR=11
[Step   16] Turn Right   Position ( 8, 11) South  LR=10
[Step   17] Move Forward Position ( 8, 12) South  LR=10
[Step   18] Move Forward Position ( 8, 13) South  LR=11
[Step   19] Turn Right   Position ( 8, 13) West   LR=10
[Step   20] Move Forward Position ( 7, 13) West   LR=10
[Step   21] Move Forward Position ( 6, 13) West   LR=10
[Step   22] Move Forward Position ( 5, 13) West   LR=10
[Step   23] Move Forward Position ( 4, 13) West   LR=11
[Step   24] Turn Right   Position ( 4, 13) North  LR=10
[Step   25] Move Forward Position ( 4, 12) North  LR=10
[Step   26] Move Forward Position ( 4, 11) North  LR=00
[Step   27] Turn Left    Position ( 4, 11) West   LR=00
[Step   28] Move Forward Position ( 3, 11) West   LR=10
[Step   29] Move Forward Position ( 2, 11) West   LR=00
[Step   30] Turn Left    Position ( 2, 11) South  LR=00
[Step   31] Move Forward Position ( 2, 12) South  LR=10
[Step   32] Move Forward Position ( 2, 13) South  LR=11
[Step   33] Turn Right   Position ( 2, 13) West   LR=10
[Step   34] Move Forward Position ( 1, 13) West   LR=11
[Step   35] Turn Right   Position ( 1, 13) North  LR=10
[Step   36] Move Forward Position ( 1, 12) North  LR=10
```

```
[Step   37] Move Forward Position ( 1, 11) North  LR=10
[Step   38] Move Forward Position ( 1, 10) North  LR=10
[Step   39] Move Forward Position ( 1,  9) North  LR=10
[Step   40] Move Forward Position ( 1,  8) North  LR=11
[Step   41] Turn Right   Position ( 1,  8) East   LR=10
[Step   42] Move Forward Position ( 2,  8) East   LR=10
[Step   43] Move Forward Position ( 3,  8) East   LR=10
[Step   44] Move Forward Position ( 4,  8) East   LR=10
[Step   45] Move Forward Position ( 5,  8) East   LR=10
[Step   46] Move Forward Position ( 6,  8) East   LR=10
[Step   47] Move Forward Position ( 7,  8) East   LR=00
[Step   48] Turn Left    Position ( 7,  8) North  LR=00
[Step   49] Move Forward Position ( 7,  7) North  LR=10
[Step   50] Move Forward Position ( 7,  6) North  LR=10
[Step   51] Move Forward Position ( 7,  5) North  LR=10
[Step   52] Move Forward Position ( 7,  4) North  LR=10
[Step   53] Move Forward Position ( 7,  3) North  LR=00
[Step   54] Turn Left    Position ( 7,  3) West   LR=00
[Step   55] Move Forward Position ( 6,  3) West   LR=10
[Step   56] Move Forward Position ( 5,  3) West   LR=10
[Step   57] Move Forward Position ( 4,  3) West   LR=11
[Step   58] Turn Right   Position ( 4,  3) North  LR=10
[Step   59] Move Forward Position ( 4,  2) North  LR=00
[Step   60] Turn Left    Position ( 4,  2) West   LR=00
[Step   61] Move Forward Position ( 3,  2) West   LR=10
[Step   62] Move Forward Position ( 2,  2) West   LR=00
[Step   63] Turn Left    Position ( 2,  2) South  LR=00
[Step   64] Move Forward Position ( 2,  3) South  LR=10
[Step   65] Move Forward Position ( 2,  4) South  LR=10
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[Step   68] Move Forward Position ( 3,  5) East   LR=10
[Step   69] Move Forward Position ( 4,  5) East   LR=10
[Step   70] Move Forward Position ( 5,  5) East   LR=11
[Step   71] Turn Right   Position ( 5,  5) South  LR=10
[Step   72] Move Forward Position ( 5,  6) South  LR=11
[Step   73] Turn Right   Position ( 5,  6) West   LR=10
[Step   74] Move Forward Position ( 4,  6) West   LR=10
[Step   75] Move Forward Position ( 3,  6) West   LR=10
[Step   76] Move Forward Position ( 2,  6) West   LR=10
[Step   77] Move Forward Position ( 1,  6) West   LR=11
[Step   78] Turn Right   Position ( 1,  6) North  LR=10
[Step   79] Move Forward Position ( 1,  5) North  LR=10
[Step   80] Move Forward Position ( 1,  4) North  LR=10
[Step   81] Move Forward Position ( 1,  3) North  LR=10
[Step   82] Move Forward Position ( 1,  2) North  LR=10
[Step   83] Move Forward Position ( 1,  1) North  LR=11
[Step   84] Turn Right   Position ( 1,  1) East   LR=10
[Step   85] Move Forward Position ( 2,  1) East   LR=10
[Step   86] Move Forward Position ( 3,  1) East   LR=10
[Step   87] Move Forward Position ( 4,  1) East   LR=10
[Step   88] Move Forward Position ( 5,  1) East   LR=10
[Step   89] Move Forward Position ( 6,  1) East   LR=00
[Step   90] Turn Left    Position ( 6,  1) North  LR=00
[Step   91] Move Forward Position ( 6,  0) North  LR=00  <You Made It!!>

<<< Total steps used:          91 >>>
>>> MAZE ESCAPED!!!

>>> Congratulations! Escape at time [               9500]
```

3. Challenge: narrow corridors or corners

   Originally, if the antenna signals are 11, it is seen as the “wall ahead” condition. However, with narrow corridors or corners, we should always assume that there is no wall ahead. Thus, the next move should be “Forward”. If there is a wall ahead, the “hit” signal would tell us that it is impossible to walk forward. Only when the “hit” signal is invoked can we be sure that the condition is “wall ahead”.

   When the antenna signals are 11, store the original move into a register and assign “Forward” to next move. At the move “Forward”, if hit signal is not invoked, then continue with forward; if hit signal is invoked, assign the register to the next move.