Q1.2

```
Initial condition: [0.2               1]'.
Transition to contact mode {1} at time t = 0.42857 s.
Transition to contact mode {2} at time t = 0.53452 s.
Transition to contact mode {1} at time t = 1.1759 s.
Transition to contact mode {2} at time t = 1.5608 s.
Transition to contact mode {1} at time t = 1.7917 s.
Transition to contact mode {2} at time t = 1.9303 s.
Transition to contact mode {1} at time t = 2.0134 s.
Transition to contact mode {2} at time t = 2.0633 s.
Transition to contact mode {1} at time t = 2.0932 s.
Transition to contact mode {2} at time t = 2.1112 s.
Transition to contact mode {1} at time t = 2.1219 s.
Transition to contact mode {2} at time t = 2.1284 s.
Transition to contact mode {1} at time t = 2.1323 s.
Transition to contact mode {2} at time t = 2.1346 s.
Transition to contact mode {1} at time t = 2.136 s.
Transition to contact mode {2} at time t = 2.1368 s.
Transition to contact mode {1} at time t = 2.1373 s.
Transition to contact mode {2} at time t = 2.1376 s.
Transition to contact mode {1} at time t = 2.1378 s.
Transition to contact mode {2} at time t = 2.1379 s.
Transition to contact mode {1} at time t = 2.138 s.
Final time reached
>>
```

One of the problems that becomes apparent is that after transitioning from mode {2} to {1}, the ball tends to slide down all the way down {1}. This is because the number of events triggered becomes so large that it bypasses ode45's counter and it thus misses the final transition when it switches to mode {1} at the end.

Q1.4

1) h = 0.04

```
Initialize in mode {}.
Transition from mode {0} to mode {1} at t = 0.4.
Transition from mode {1} to mode {12} at t = 0.48.
Transition from mode {12} to mode {2} at t = 0.52.
Transition from mode {2} to mode {1} at t = 1.
Transition from mode {1} to mode {12} at t = 1.16.
>>
```

2) h = 0.02

```
Initialize in mode {}.
Transition from mode {0} to mode {1} at t = 0.4.
Transition from mode {1} to mode {2} at t = 0.52.
Transition from mode {2} to mode {12} at t = 1.1.
Transition from mode {12} to mode {1} at t = 1.12.
Transition from mode {1} to mode {12} at t = 1.42.
Transition from mode {12} to mode {2} at t = 1.44.
Transition from mode {2} to mode {12} at t = 1.54.
>>
```

3) h = 0.01

```
Initialize in mode {}.
Transition from mode {0} to mode {1} at t = 0.42.
Transition from mode {1} to mode {2} at t = 0.52.
Transition from mode {2} to mode {1} at t = 1.12.
Transition from mode {1} to mode {2} at t = 1.45.
Transition from mode {2} to mode {12} at t = 1.62.
Transition from mode {12} to mode {1} at t = 1.63.
Transition from mode {1} to mode {12} at t = 1.69.
Transition from mode {12} to mode {2} at t = 1.7.
Transition from mode {2} to mode {12} at t = 1.71.
>>
```

In the event based simulation, the ball tends to slide down the path 1 after it reaches the final contact mode of {1} whereas in the time stepping simulation, the eom solver can handle higher oscillation frequencies and as a result the ball is able to oscillate and end up at the {1,2} contact mode.