

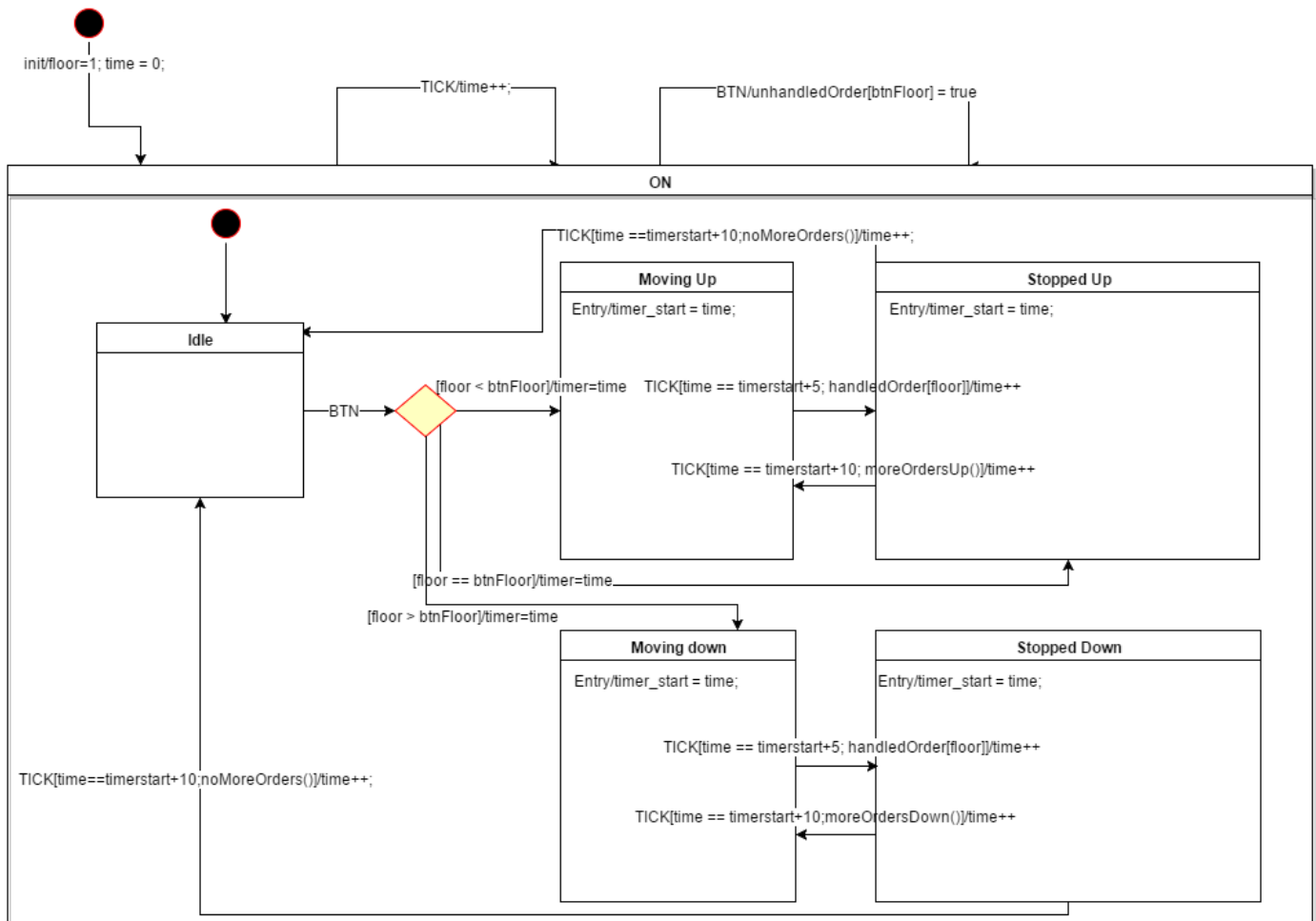
Homework 5

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Problem 1

Five different states were added here, an Idle state where the elevator is not doing anything, moving_up / moving_down states, and stopped_up / stopped_down states. Two boolean lists are created, one for unhandled orders where button presses initially go, and one for handled orders where unhandled orders are placed at floor and stop. A not completely specified UML chart is seen below. The final model ended up with more logic and guards.



The final states were:

TOP
IDLE
UP_MOVING
UP_STOPPED
DOWN_MOVING
DOWN_STOPPED

The events were:

BTN
TICK

The guards were:

```
recentFloor
unassignedOrder[5]
assignedOrder[5]
curr_time
timer_start
```

For the input sequence pair (time,button), $\{(0,2), (20,3), (50,5), (100,2), (110, 5), (150,3), (200, 4), (210,1)\}$, we get the movement and times seen below.

```
C:\Users\adrian_2\Documents\Skole\2017H\ECE 253\embedded-ucsb\hw5>hsmelevator.exe test.txt
Moving up, time = 0
Opening doors, time = 5
Moving up, time = 20
Opening doors, time = 25
Moving up, time = 50
Opening doors, time = 60
Moving down, time = 100
Opening doors, time = 115
Moving up, time = 125
Opening doors, time = 140
Moving down, time = 150
Opening doors, time = 160
Moving up, time = 200
Opening doors, time = 205
```

Problem 2

Running the model with the delay times $\{200,100,50,25,10\}$, by taking the average of 10000 button presses we get the following values:

```
C:\Users\adrian_2\Documents\Skole\2017H\ECE 253\embedded-ucsb\hw5>hsmelevator.exe test.tst
```

```
Elevator model, button press every 200 seconds
```

```
95 confidence interval for 1: [10.162204, 10.121951]  
95 confidence interval for 2: [6.921958, 6.959036]  
95 confidence interval for 3: [5.893300, 6.111111]  
95 confidence interval for 4: [6.907500, 7.135204]  
95 confidence interval for 5: [9.924204, 10.154118]
```

```
Elevator model, button press every 100 seconds
```

```
95 confidence interval for 1: [9.909046, 10.290372]  
95 confidence interval for 2: [7.149722, 7.100503]  
95 confidence interval for 3: [6.068931, 5.965551]  
95 confidence interval for 4: [7.066467, 6.963284]  
95 confidence interval for 5: [10.110831, 10.153162]
```

```
Elevator model, button press every 50 seconds
```

```
95 confidence interval for 1: [9.869502, 10.032210]  
95 confidence interval for 2: [6.990291, 6.847658]  
95 confidence interval for 3: [6.086745, 6.092843]  
95 confidence interval for 4: [6.981771, 7.035533]  
95 confidence interval for 5: [10.259870, 10.055000]
```

```
Elevator model, button press every 25 seconds
```

```
95 confidence interval for 1: [10.511911, 10.409712]  
95 confidence interval for 2: [7.811214, 7.597765]  
95 confidence interval for 3: [7.055696, 6.590686]  
95 confidence interval for 4: [8.258176, 8.023606]  
95 confidence interval for 5: [10.440252, 10.407062]
```

```
Elevator model, button press every 10 seconds
```

```
95 confidence interval for 1: [18.061237, 17.927307]  
95 confidence interval for 2: [17.331380, 21.771574]  
95 confidence interval for 3: [18.391834, 21.180280]  
95 confidence interval for 4: [15.597884, 17.576056]  
95 confidence interval for 5: [17.558896, 21.666667]
```

Note that if the same button is pressed multiple times for a floor before reaching that floor, we only count the time from the first button press. We see that wait times increases drastically as the number of button presses goes up, and that there is symmetry around the middle floor.