

In the Name of God

Reactive Classes:

Autonomous Car:

- what does it do??

- Goes all the way up
- Goes all the way down
- Sometimes needs to wait because the shouldStop signal is issued
- Know rebecs: Infrastructure
- constructor argument: nothing!
- Message servers:

```
149  msgsrv canAutoMove(boolean canMove) {  
150      shouldStop = canMove;  
151      asked = true;  
152  }  
153  
154  msgsrv live() {  
155      move();  
156  }  
157
```

- **Methods:**

```
void move() {

    if (asked || firstStep) {

        firstStep = false;
        infra.isAutoAllowed(line, block);
        asked = false;

        if (!shouldStop) {
            if (up && block == MAX_BLOCK_NUM) {
                block--;
                up = !up;
            }

            if (!up && block == 0) {
                up = !up;
                block++;
            }

            if (up && block < MAX_BLOCK_NUM && block > 0) {
                block++;
            }

            if (!up && block < MAX_BLOCK_NUM && block > 0) {
                block--;
            }
        }

        shouldStop = true;
    }

    self.live();
}
```

- **Queue capacity: 3**
- **The live method was added to the actor's class to avoid deadlocks**

Manned Car:

-what does it do??

- Goes wherever it wants
- Known Rebecs: Infrastructure
- Methods:

```
void move() {  
  
    if (asked || firstStep) {  
  
        firstStep = false;  
        infra.isMannedAllowed(line, block);  
        asked = false;  
  
        if (shouldChange) {  
            line = !line;  
        } else {  
            self.randomMove();  
        }  
  
        if (up && block == MAX_BLOCK_NUM) {  
            block--;  
            up = !up;  
        }  
  
        if (!up && block == 0) {  
            up = !up;  
            block++;  
        }  
  
        if (up && block < MAX_BLOCK_NUM && block > 0) {  
            block++;  
        }  
  
        if (!up && block < MAX_BLOCK_NUM && block > 0) {  
            block--;  
        }  
  
    }  
  
    self.live();  
}
```

- Message servers:

```
222  
223= msgsrv canMannedMove(boolean canMove) {  
224     shouldChange = canMove;  
225     asked = true;  
226 }  
227  
228= msgsrv live() {  
229     move();  
230 }  
231  
232= msgsrv randomMove() {  
233     up = ?(true, false);  
234     randomMoved = true;  
235 }  
236
```

Infrastructure:

-what does it do??

- Known Rebecs: Infrastructure
- Queue Capacity: 6
- Methods: doesn't have any!
- Message servers:

```
83
84  msgsrv isAutoAllowed(boolean line, int block, int autoId) {
85      autoCars[autoId] = ((Auto) sender);
86      ctrl.isAutoAllowed(line, block, autoId);
87  }
88
89  msgsrv canAutoMove(boolean canMove, int autoId) {
90      autoCars[autoId].canAutoMove(canMove);
91  }
92
93  msgsrv isMannedAllowed(boolean line, int block, int mannedId) {
94      mannedCars[mannedId] = ((Manned) sender);
95      ctrl.isMannedAllowed(line, block, mannedId);
96  }
97
98  msgsrv canMannedMove(boolean canMove, int mannedId) {
99      mannedCars[mannedId].canMannedMove(canMove);
100 }
```

Controller:

- Know rebecs: Infrastructure, Autonomous, Manned
- Constructor argument:
- Message server: checkAccident → is called whenever a message is sent to either of the 2 channels and checks the condition of the moving cars and if they are about to have an accident, a stop signal is issued to the autonomous car or the changeLine signal is issued to the manned car
- StateVars:

```
8
9 statevars {
10     boolean [10] shouldStop;
11     boolean [10] shouldChangeLine;
12
13     boolean [10] autoLine;
14     boolean [10] mannedLine;
15
16     int [10] autoBlock;
17     int [10] mannedBlock;
18 }
19
```

- Check method:

```
35
36 void check() {
37     for (int i = 0; i < MAX_BLOCK_NUM; i++) {
38
39         for(int j = 0; j < MAX_BLOCK_NUM; j++) {
40
41             if (autoLine[i] != mannedLine[j] && (autoBlock[i] == mannedBlock[j]+1 || autoBlock[i] == mannedBlock[j]+1) ) {
42                 shouldStop[i] = true;
43             }
44
45             if (autoLine[i] == mannedLine[j] && (autoBlock[i] == mannedBlock[j]+1 || autoBlock[i] == mannedBlock[j]+1) ) {
46                 shouldStop[i] = true;
47                 shouldChangeLine[j] = true;
48             }
49         }
50     }
51 }
52
53
```

- **Message servers:**

```
53
54 msgsrv isAutoAllowed(boolean line, int block, int autoId) {
55     autoBlock[autoId] = block;
56     autoLine[autoId] = line;
57
58     check();
59     ((Infrastructure)sender).canAutoMove(shouldStop[autoId], autoId);
60 }
61
62 msgsrv isMannedAllowed(boolean line, int block, int mannedId) {
63     mannedBlock [mannedId] = block;
64     mannedLine [mannedId] =line;
65
66     check();
67     ((Infrastructure)sender).canMannedMove(shouldChangeLine[mannedId], mannedId);
68 }
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```

- **Queue capacity: 6**

Results for 1 autonomous car and 1 manned car:

Problems Analysis Result Console	
Attribute	Value
▼ SystemInfo	
Total Spent Time	1
Number of Reached S	81
Number of Reached T	202
Consumed Memory	1296
▼ CheckedProperty	
Property Name	Deadlock-Freedom and No Deadline Missed
Property Type	Reachability
Analysis Result	satisfied

Results for 2 autonomous cars and 2 manned cars:

Problems Analysis Result Console	
Attribute	Value
▼ SystemInfo	
Total Spent Time	2
Number of Reached S	6561
Number of Reached T	32563
Consumed Memory	157464
▼ CheckedProperty	
Property Name	Deadlock-Freedom and No Deadline Missed
Property Type	Reachability
Analysis Result	satisfied

Properties:

1. Each autonomous car should finish its path: (for 1 car)

shit.rebeca

shit.property x

```
1 property {
2
3   define {
4     finished = auto1.lastStep;
5   }
6
7   LTL {
8     Starvation: F (finished);
9   }
10 }
```

Problems

Analysis Result

Console

Attribute	Value
▼ SystemInfo	
Total Spent Time	0
Number of Reached S	32
Number of Reached T	179
Consumed Memory	2048
▼ CheckedProperty	
Property Name	Starvation
Property Type	LTL
Analysis Result	satisfied

With 2 cars:

R shit.rebeca
P shit.property ×

```

1 property {
2
3   define {
4     finished1 = auto1.lastStep;
5     finished2 = auto2.lastStep;
6   }
7
8   LTL {
9     Starvation1: F (finished1);
10    Starvation2: F (finished2);
11  }
12 }
13

```

Problems
Analysis Result
Console

Attribute	Value
▼ SystemInfo	
Total Spent Time	1
Number of Reached S	965
Number of Reached T	14071
Consumed Memory	69480
▼ CheckedProperty	
Property Name	Starvation2
Property Type	LTL
Analysis Result	satisfied

2. Safety property:

```

1 property {
2
3     define {
4         finished1 = auto1.lastStep;
5         //finished2 = auto2.lastStep;
6
7         isSafetyViolated = ctrl.safetyCheck;
8     }
9
10    LTL {
11
12        Starvation1: F (finished1);
13        //Starvation2: F (finished2);
14
15        Safety: G(!isSafetyViolated);
16    }
17 }
18

```

Problems Analysis Result Console

Attribute	Value
▼ SystemInfo	
Total Spent Time	0
Number of Reached S	189
Number of Reached T	491
Consumed Memory	12096
▼ CheckedProperty	
Property Name	Safety
Property Type	LTL
Analysis Result	satisfied

Is safety violated was defined in the controller environment:

```

void check() {
    for (int i = 0; i < MAX_BLOCK_NUM; i++) {
        for(int j = 0; j < MAX_BLOCK_NUM; j++) {
            if (autoLine[i] != mannedLine[j] && (autoBlock[i] == mannedBlock[j]+1 || autoBlock[i] == mannedBlock[j]+1) ) {
                shouldStop[i] = true;
            }
            if (autoLine[i] == mannedLine[j] && (autoBlock[i] == mannedBlock[j]+1 || autoBlock[i] == mannedBlock[j]+1) ) {
                shouldStop[i] = true;
                shouldChangeLine[j] = true;
            }
            if (autoLine[i] == mannedLine[j] && autoBlock[i] == mannedBlock[j]) {
                safetyCheck = true;
            }
        }
    }
}

```