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SE-450 Project Deliverable Final Report

1-Project Directory:

C:\Users\Owner\Desktop\FinalProjectDeliverable\FinalProjectDeliverable\build.xml

2- Screen Shot Showing project compile, test, and run:

- Test: Fail=0
- Project compile
- Project run

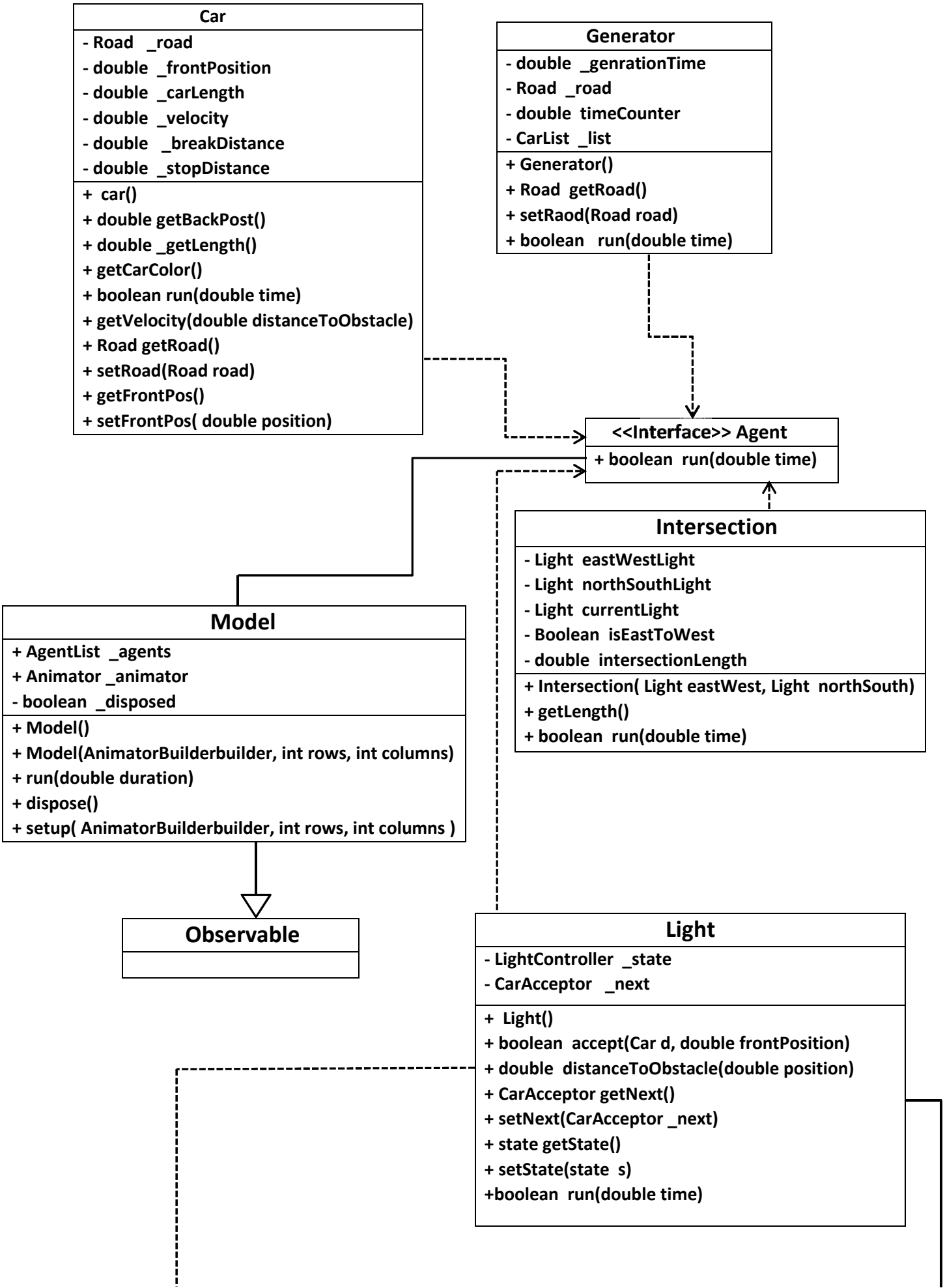
```
Buildfile:
C:\Users\Owner\Desktop\FinalProjectDeliverable\FinalProjectDeliverable\build.xml
build-subprojects:
init:
build-project:
     [echo] FinalProjectDeliverable:
C:\Users\Owner\Desktop\FinalProjectDeliverable\FinalProjectDeliverable\build.xml
build:
UtilTEST:
    [junit] Running project.random.UtilTEST
    [junit] Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.082 sec
IntersectionTest:
    [junit] Running project.model.IntersectionTest
    [junit] Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.093 sec
RoadTest:
    [junit] Running project.model.RoadTest
    [junit] Tests run: 3, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.103 sec
CarTest:
    [junit] Running project.model.CarTest
    [junit] Tests run: 5, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.089 sec
BUILD SUCCESSFUL
Total time: 3 seconds
```

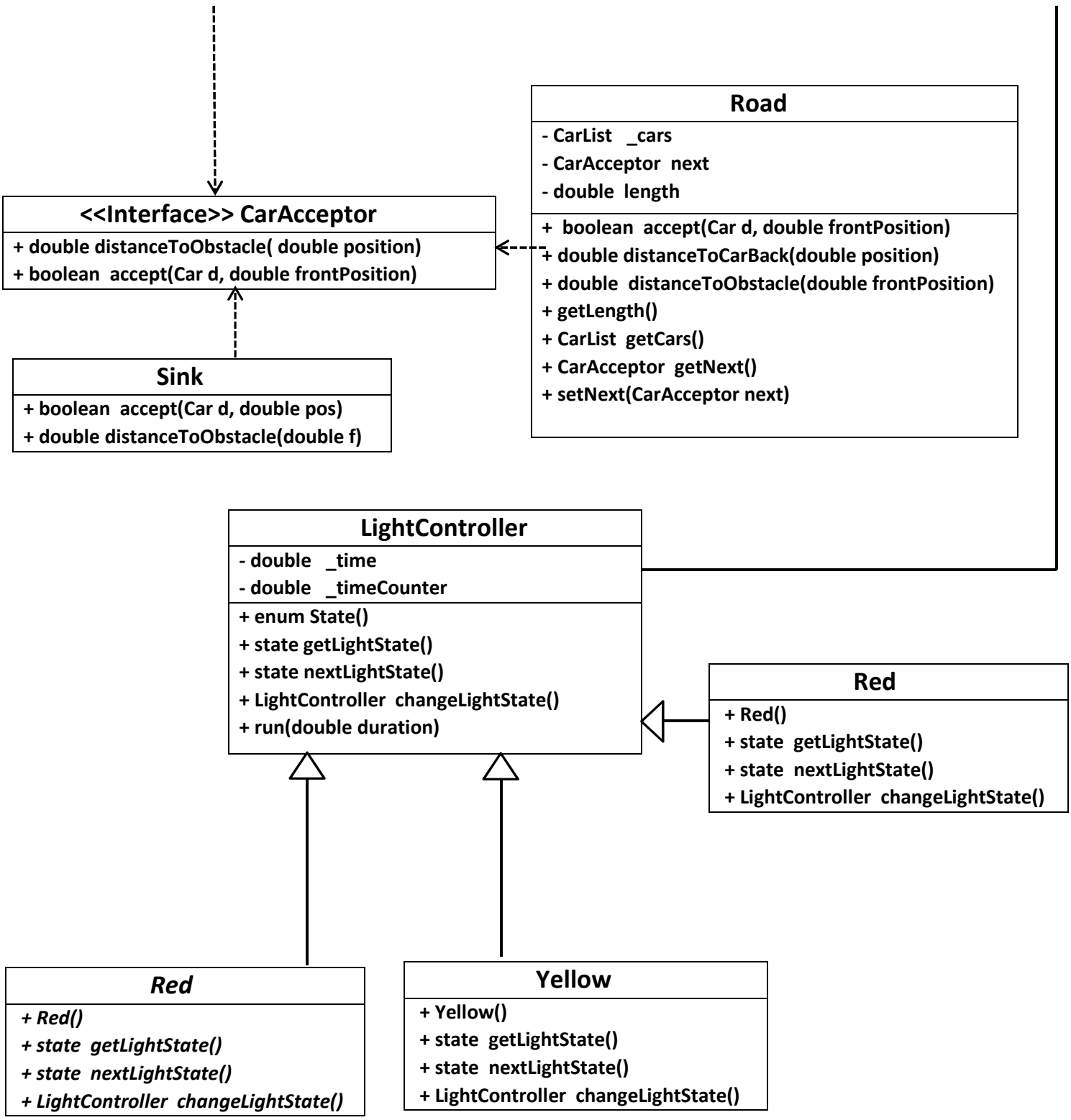
3-Timesheet:

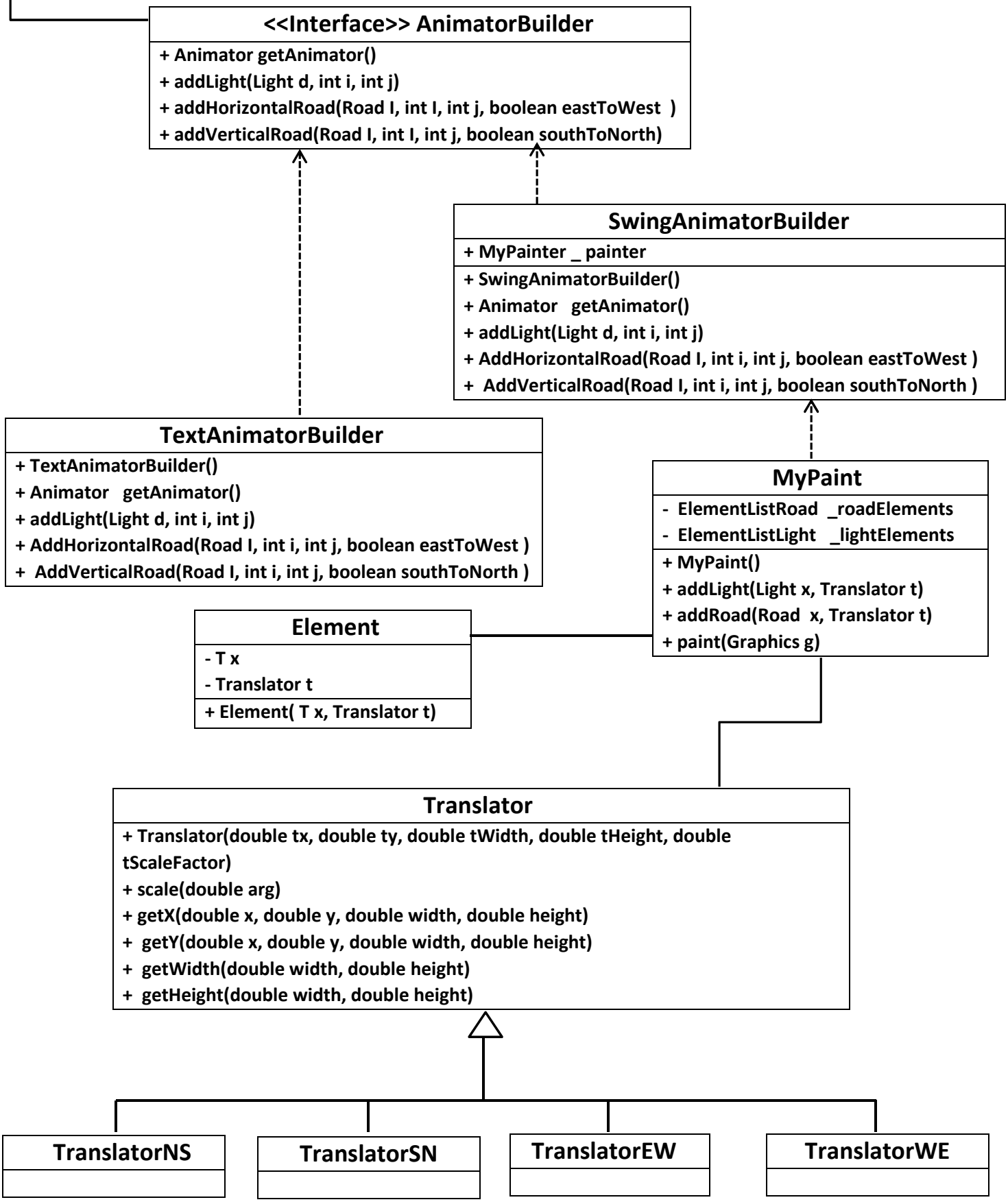
Week	01	02	03	04	Total
Coding	6	18	15	12	51
Design	4	9	4	5	22
Bigbug	3	6	3	6	18

4-Class Diagram:

Interface: Agent, CarAcceptor, AnimatorBuilder
Classes: Model, Car, Generator, Intersection, Model,Road, Sink, Light(lightController(Red,Yellow,and Green)), SwingAnimatorBuilder, and TextAnimatorBuilder.


Car
- Road _road
- double _frontPosition
- double _carLength
- double _velocity
- double _breakDistance
- double _stopDistance
+ car()
+ double getBackPost()
+ double _getLength()
+ getCarColor()
+ boolean run(double time)
+ getVelocity(double distanceToObstacle)
+ Road getRoad()
+ setRoad(Road road)
+ getFrontPos()
+ setFrontPos(double position)
Generator
- double _genrationTime
- Road _road
- double timeCounter
- CarList _list
+ Generator()
+ Road getRoad()
+ setRaod(Road road)
+ boolean run(double time)
<<Interface>> Agent
+ boolean run(double time)
Intersection
- Light eastWestLight
- Light northSouthLight
- Light currentLight
- Boolean isEastToWest
- double intersectionLength
+ Intersection(Light eastWest, Light northSouth)
+ getLength()
+ boolean run(double time)
Model
+ AgentList _agents
+ Animator _animator
- boolean _disposed
+ Model()
+ Model(AnimatorBuilderbuilder, int rows, int columns)
+ run(double duration)
+ dispose()
+ setup(AnimatorBuilderbuilder, int rows, int columns)
Observable
Light
- LightController _state
- CarAcceptor _next
+ Light()
+ boolean accept(Car d, double frontPosition)
+ double distanceToObstacle(double position)
+ CarAcceptor getNext()
+ setNext(CarAcceptor _next)
+ state getState()
+ setState(state s)
+boolean run(double time)


Road
- CarList _cars
- CarAcceptor next
- double length
+ boolean accept(Car d, double frontPosition)
+ double distanceToCarBack(double position)
+ double distanceToObstacle(double frontPosition)
+ getLength()
+ CarList getCars()
+ CarAcceptor getNext()
+ setNext(CarAcceptor next)
<<Interface>> CarAcceptor
+ double distanceToObstacle(double position)
+ boolean accept(Car d, double frontPosition)
Sink
+ boolean accept(Car d, double pos)
+ double distanceToObstacle(double f)
LightController
- double _time
- double _timeCounter
+ enum State()
+ state getLightState()
+ state nextLightState()
+ LightController changeLightState()
+ run(double duration)
Red
+ Red()
+ state getLightState()
+ state nextLightState()
+ LightController changeLightState()
Red
+ Red()
+ state getLightState()
+ state nextLightState()
+ LightController changeLightState()
Yellow
+ Yellow()
+ state getLightState()
+ state nextLightState()
+ LightController changeLightState()


<<Interface>> AnimatorBuilder
+ Animator getAnimator()
+ addLight(Light d, int i, int j)
+ addHorizontalRoad(Road I, int I, int j, boolean eastToWest)
+ addVerticalRoad(Road I, int I, int j, boolean southToNorth)
SwingAnimatorBuilder
+ MyPainter _ painter
+ SwingAnimatorBuilder()
+ Animator getAnimator()
+ addLight(Light d, int i, int j)
+ AddHorizontalRoad(Road I, int i, int j, boolean eastToWest)
+ AddVerticalRoad(Road I, int i, int j, boolean southToNorth)
TextAnimatorBuilder
+ TextAnimatorBuilder()
+ Animator getAnimator()
+ addLight(Light d, int i, int j)
+ AddHorizontalRoad(Road I, int i, int j, boolean eastToWest)
+ AddVerticalRoad(Road I, int i, int j, boolean southToNorth)
MyPaint
- ElementListRoad _roadElements
- ElementListLight _lightElements
+ MyPaint()
+ addLight(Light x, Translator t)
+ addRoad(Road x, Translator t)
+ paint(Graphics g)
Element
- T x
- Translator t
+ Element(T x, Translator t)
Translator
+ Translator(double tx, double ty, double tWidth, double tHeight, double tScaleFactor)
+ scale(double arg)
+ getX(double x, double y, double width, double height)
+ getY(double x, double y, double width, double height)
+ getWidth(double width, double height)
+ getHeight(double width, double height)
TranslatorNS
TranslatorSN
TranslatorEW
TranslatorWE

5- Design Pattern:

- **State pattern:**

  The intent of this pattern is to allow an object to alter its behavior when its internal state changes, the object will appear to change its class. It is known as object for states. The State Pattern is used when object behavior depends on object state and I want to avoid complex if-else statement. So, I used this pattern to control the intersection light in each road. I assigned the light to be at the green state, then it is changing to the yellow state for a moment of time, and finally the light state will be assigned to the red color. The process will be repeated again by assigning light state to the green color. The abstract class that control the light to be changed is **lightController** which it is using **changeLightState().**

- **Builder pattern:**

  The pattern allows a client object to construct a complex object by specifying only its type and content, being exposed to the difficulty from the details related to the object representations. This way the construction process can be used to create different representations. The logic of this process is isolated form the actual steps used in creating the complex object, so the process can be used again to create a different object form the same set of simple objects as the first one**.** I used an interface **AnimatorBuilder** and I implemented a **SwingAnimitorBuilder** and **TextAnimitorBuilder** for that interface, which going to build whether a swing or text animator.

- **Strategy pattern:**

  This pattern is Define a family of algorithms, encapsulate each one, and make them interchangeable. Strategy pattern lets the algorithm vary independently from clients that use it. So, in this case I created interfaces **Agent**, and **carAcceptor** to my design and I have an implementation for each interface in the **Car**, **Road** classes.

- **Observer pattern:**

  The Pattern for this case when certain objects need to be informed about the changes occurred in other objects. Design Pattern can be used whenever a subject has to be observed by one or more observers. It is to define a one-to-many dependency between objects so that when one object changes state, all its dependents are notified and updated automatically. The pattern is used in the Model class. It extends the observer class. It is considered the view in the Model-View- Controller (MVC). I made use of **setChanged()** and **notifyObservers()** method to set change and notify all the subscribers.

6-Successes and Failures:

- **What does it Work:**

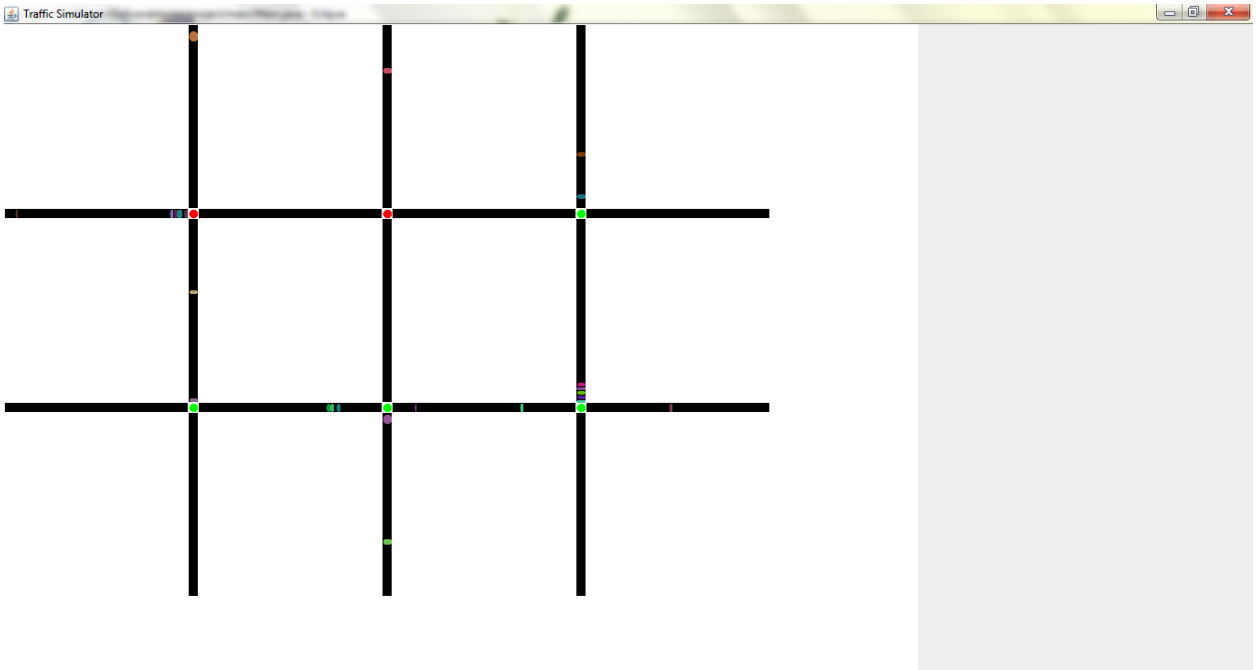
  I successfully get the cars moving without any collision. And the car moves with different colors, sizes, and speed. I perfectly succeed to create traffic light that provokes the cars to stop, move or slow down without any collision. I created test cases **CarTest, RoadTest, IntesectionTest, and UtilTEST** for the classes Car, Road,Intersection, and Util.

- **What Does not Work:**

  I tried to create in each intersection two traffic lights and each traffic light on that intersection change from green followed by yellow and finally red. I could not do it. But I will try to do later.

Screen Shoot of Running Program:

```
Enter Your Choice By Number:
  1. Run Traffic Simulation
  2. Change Traffic Simulation Parameters
  3. Exit Traffic Simulation
1
```




```
Project Traffic Simulation
Enter Your Choice By Number:
  1. Run Traffic Simulation
  2. Change Traffic Simulation Parameters
  3. Exit Traffic Simulation
2
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
```

```
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
  8. Traffic Simulation Intersection Length
  9. Traffic Simulation Car Length
  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
1
Simulation time step (seconds)   [0.5]
Simulation run time (seconds)    [850.0]
Grid size (number of roads)      [row=2,column=3]
Traffic pattern                   [alternate]
Car Generated  (seconds/car)      [min=15.0,max=30.0]
Road length (meters)              [min=200.0,max=600.0]
Intersection length (meters)       [min=8.0,max=16.0]
Car length (meters)                [min=5.0,max=16.0]
Car maximum velocity (meters/second) [min=12.0,max=24.0]
Car stop distance (meters)           [min=0.5,max=2.5]
Car brake distance (meters)          [min=9.0,max=15.0]
Green light time (seconds)           [min=35.0,max=120.0]
Yellow light time (seconds)          [min=3.0,max=6.0]

Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
  8. Traffic Simulation Intersection Length
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  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu

Oops Error!!
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
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  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
2
Traffic Simulation Time Step: [0.5]:
You Entered Invalid Input.  Please Try Again.
```

```
Traffic Simulation Time Step: [0.5]:
You Entered Invalid Input.  Please Try Again.
Traffic Simulation Time Step: [0.5]: 0.5
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
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  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
3
Traffic Simulation Run Time: [850.0]: 850.0
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
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  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
4
Rows: [2]: 2
Columns: [3]: 3
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
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  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
5
Traffic Simulation Pattern: (simple or alternate) : simple
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
```

```
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
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  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
6
Minimum Car Generated: [15.0]: 15.0
Maximum Car Generated: [30.0]: 30
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
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  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
6
Minimum Car Generated: [15.0]:
You Entered Invalid Input.  Please Try Again.
Minimum Car Generated: [15.0]: 15
Maximum Car Generated: [30.0]: 30
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
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  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
7
Min [200.0]: 200.0
Max [600.0]: 400.0
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
```

```
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
  8. Traffic Simulation Intersection Length
  9. Traffic Simulation Car Length
  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
8
Minimum Intersection Length  [8.0]: 8.0
Maximum Intersection Length [16.0]: 15.0
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
  8. Traffic Simulation Intersection Length
  9. Traffic Simulation Car Length
  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
9
Minimum Car Length [5.0]: 5.0
Maximum Car Length [16.0]: 13.0
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
  8. Traffic Simulation Intersection Length
  9. Traffic Simulation Car Length
  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
9
Minimum Car Length [5.0]: 5.0
Maximum Car Length [13.0]: 13.0
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
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  8. Traffic Simulation Intersection Length
  9. Traffic Simulation Car Length
  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
10
Minimum Car Maximum Velocity [12.0]: 12.0
Maximum Car Maximum Velocity [24.0]: 20.0
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
  8. Traffic Simulation Intersection Length
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  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
12
Minimum Car Braking Distance [9.0]: 9.0
Maximum Car Braking Distance [15.0]: 13
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
  8. Traffic Simulation Intersection Length
  9. Traffic Simulation Car Length
  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
13
Minimum Green Light Time [35.0]: 35
Maximum Green Light Time [120.0]: 111
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
  7. Traffic Simulation Road Length
  8. Traffic Simulation Intersection Length
  9. Traffic Simulation Car Length
  10. Traffic Simulation Car Maximum Velocity
  11. Traffic Simulation Car Stopping Distance
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```
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
14
Minimum Yellow Light Time [3.0]: 3
Maximum Yellow Light Time [6.0]: 5
Change Traffic Simulation Parameters
Enter Your Choice By Number:
  1. Show Current Values
  2.  Traffic Simulation Time Step
  3. Traffic Simulation Run Time
  4. Traffic Simulation Grid Size
  5. Traffic Simulation Pattern
  6. Traffic Simulation Generated Car
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  11. Traffic Simulation Car Stopping Distance
  12. Traffic Simulation Car Braking Distance
  13. Traffic Simulation Green Light Time
  14. Traffic Simulation Yellow Light Time
  15. Reset Traffic Simulation and Return To The Main Menu
15
Project Traffic Simulation
Enter Your Choice By Number:
  1. Run Traffic Simulation
  2. Change Traffic Simulation Parameters
  3. Exit Traffic Simulation
3
Are you sure you want to exit?
Enter Your Choice By Number:
  1. Yes
  2. No
2
Project Traffic Simulation
Enter Your Choice By Number:
  1. Run Traffic Simulation
  2. Change Traffic Simulation Parameters
  3. Exit Traffic Simulation
```