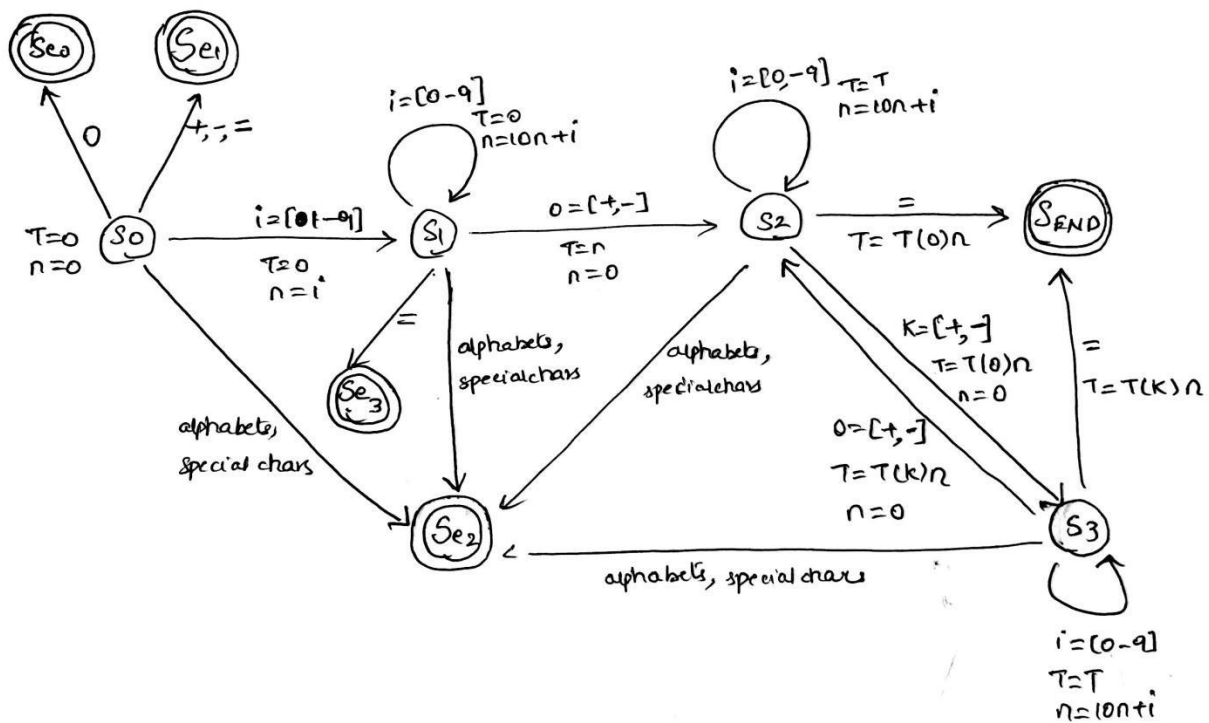# CALCULATOR USING STATE DESIGN PATTERN

- Designing the state machine first and translate into the State Design Pattern
- Calculator must compute correctly the expression
- Handle the cases where users type in invalid inputs (e.g. 10.3 or *)
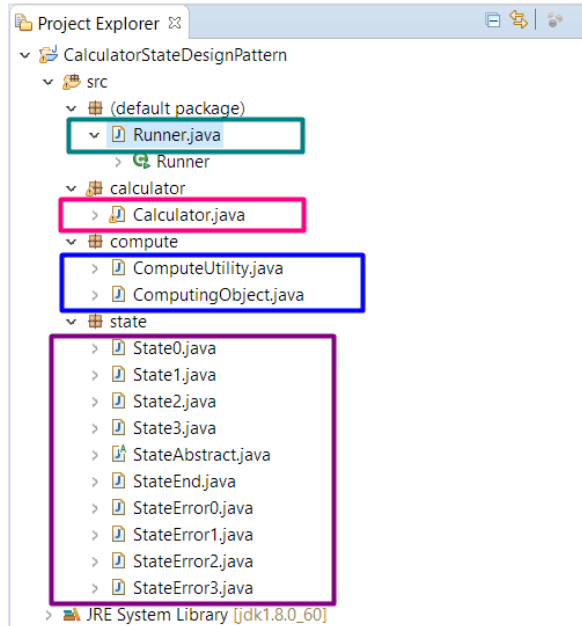
## Finite State Machine



CALCULATOR FINITE STATE MACHINE

**Code Structure and Details**

The code is attached in the zip.

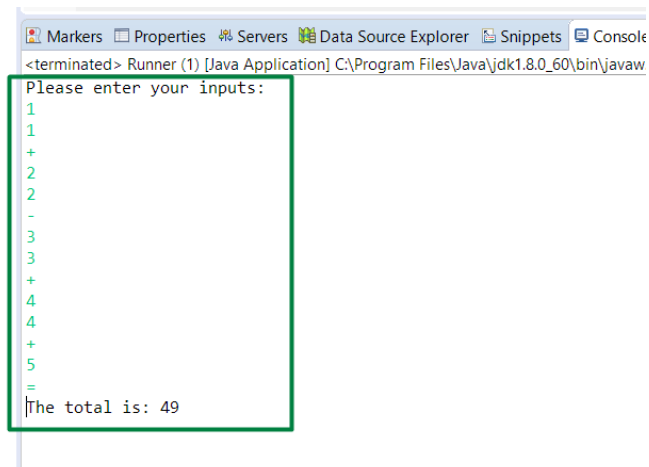Below is the structure of the file and output after running the main class



Details

- Calculator.java- The Calculator class which takes input from the user and process each character
- Runner.java- The main class which calls the *run()* method in Calculator
- ComputingObject.java, ComputingUtility.java- These classes represent the object where the computed input is stored and also have the business logic for performing the computation
  - o The inputs are stored in the variables *total, input, operator*
  - o The calculation for each state update is performed in each method separately
  - o If there's a change in the business logic, then only the ComputeUtility.java class is impacted and it's methods are changed to reflect the new logic
- StateAbstract.java- this is the abstract class containing the empty *processInput(), returnError()* methods
- StateError0-StateError3.java – Individual singleton classes for the Error States [0-3] implementing *returnError()* with appropriate error string message
  - o StateError0.java-Singleton class which is reached when the initial input from State0 is 0
  - o StateError1.java-Singleton class which is reached when the initial input from State0 is +,- or =
  - o StateError2.java-Singleton class which is reached when the non numeric or characters other than +,- are provided in State0/State1/State2/State3
  - o StateError3.java-Singleton class which is reached when = is provided at State1

- State0-State3, StateEnd.java – Individual singleton classes for the states in the FSA implementing *processInput()*
  - State0.java - Initial state which accepts inputs 1-9 and reaches error states StateError0/ StateError1/ StateError2 with invalid inputs
    - Flow
      - Accepts the valid inputs
      - Updates computing variables in calculator
      - Transitions to the State1
  - State1.java - Second state which accepts inputs 0-9, +,- and reaches error states StateError2/ StateError3 with invalid inputs
    - Flow
      - Accepts the valid inputs
      - Updates computing variables in calculator
      - Transitions to State1 or State2 based on input
  - State2.java - Third state which accepts inputs 0-9,=,+,- and reaches error state StateError2 with invalid input and StateEnd on = input
    - Flow
      - Accept valid inputs
      - Updates computing variables in calculator
      - Transitions to State3 or StateEnd based on input
  - State3.java- Fourth state which accepts inputs 0-9,=,+,- and reaches error state StateError2 with invalid input and StateEnd on = input
    - Flow
      - Accept valid inputs
      - Updates computing variables in calculator
      - Transitions to State2 or StateEnd based on input

Output

Positive Test Cases



```
Markers  Properties  Servers  Data Source Explorer  Snippets  Console
<terminated> Runner (1) [Java Application] C:\Program Files\Java\jdk1.8.0_60\bin\javaw
Please enter your inputs:
1
1
+
2
2
-
3
3
+
4
4
+
5
=
The total is: 49
```

```
Markers  Properties  Servers  Data Source Explorer  Snippets  Con
<terminated> Runner (1) [Java Application] C:\Program Files\Java\jdk1.8.0_60\bin\jav
Please enter your inputs:
4
6
7
+
5
-
9
8
2
4
+
4
9
2
-
5
=
The total is: -8865
```

```
<terminated> Runner (1) [Java Application] C:\Program Files\Java\jdk1.8.0_60\bin\javaw.exe (Mar 17, 2019, 11:38:10 AM)
Please enter your inputs:
1
2
3
+
5
0
0
-
1
2
3
+
9
7
0
-
3
0
0
+
3
0
=
The total is: 1200
```

Negative Test Cases

```
Markers  Properties  Servers  Data Source Explorer  Snippets  Console
<terminated> Runner (1) [Java Application] C:\Program Files\Java\jdk1.8.0_60\bin\javaw.exe
Please enter your inputs:
4
6
7
-
9
*
User Input Error. Please recheck your inputs and try again.
ERROR: CALC-4298
DETAILS: Only valid characters are [0-9] and + and -.
```

<terminated> Runner (1) [Java Application] C:\Program Files\Java\jdk1.8.0_60\bin\javaw.exe (Ma

```
Please enter your inputs:
-
User Input Error. Please recheck your inputs and try again.
ERROR: CALC-4297
DETAILS: '+', '-' or '=' is not a valid first input.
```

<terminated> Runner (1) [Java Application] C:\Program Files\Java\jdk1.8.0_60\bin\javaw.exe (Mar 17, 2019

```
Please enter your inputs:
4
6
+
9
-
9
.
User Input Error. Please recheck your inputs and try again.
ERROR: CALC-4298
DETAILS: Only valid characters are [0-9] and + and -.
```