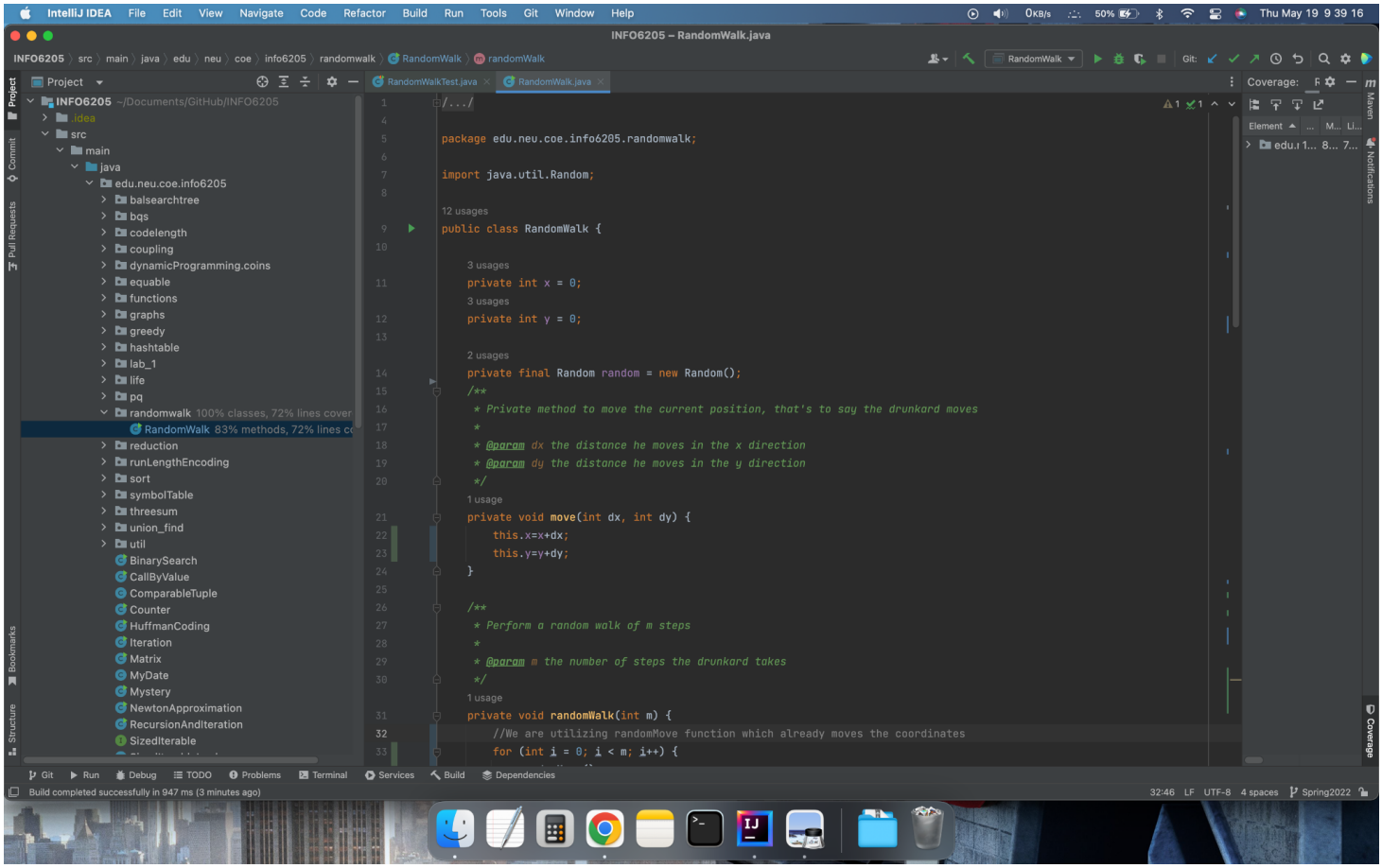
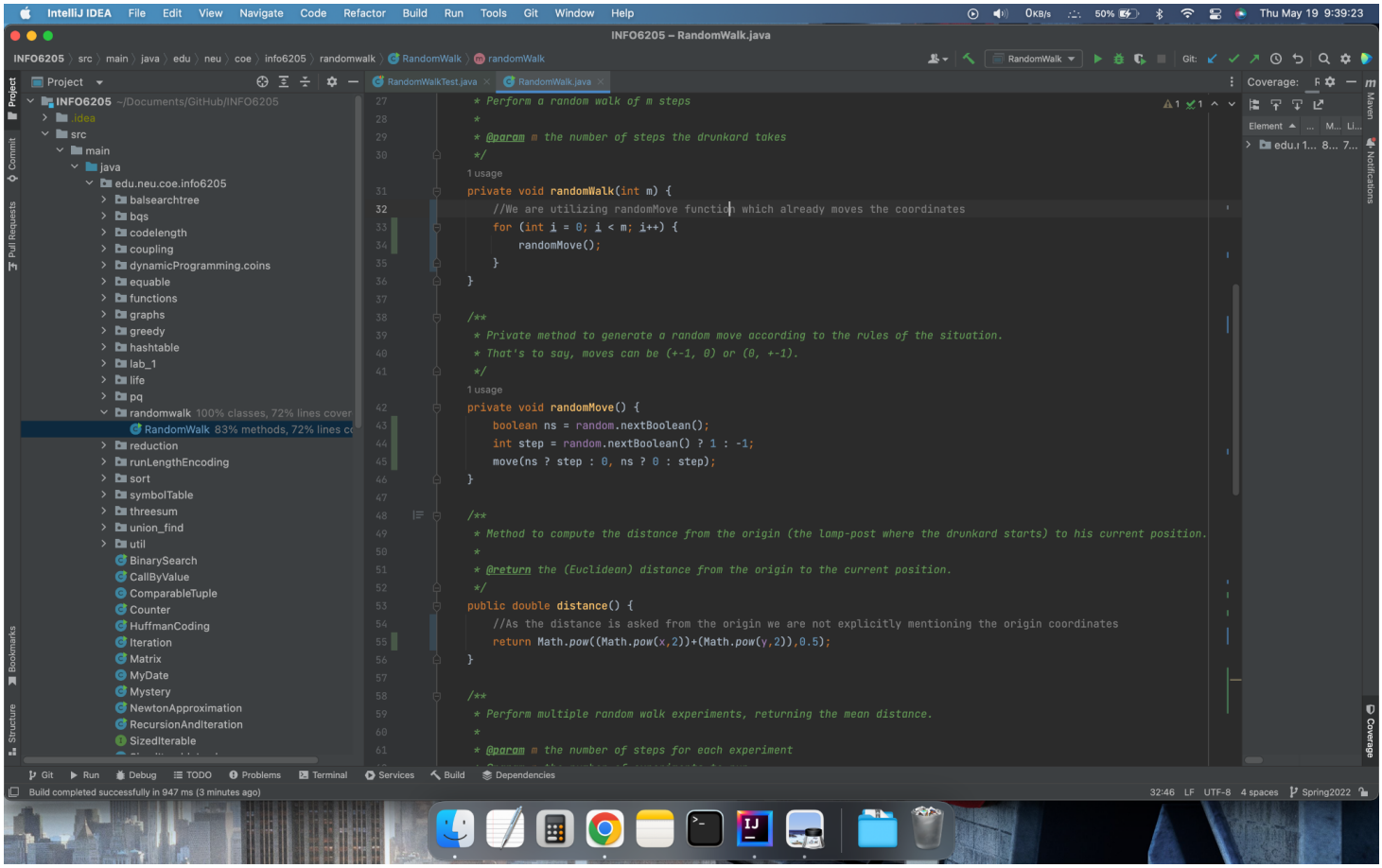
INFO6205 - Program Structures and Algorithms

Assignment 01 - Random Walk Algorithm

Implemented Functions marked as “FIXME” in RandomWalk.java class file

- **move(int dx,int dy)**
- **randomWalk(int m)**
- **distance()**
- **Main method in RandomWalk.java for custom test cases**




IntelliJ IDEA File Edit View Navigate Code Refactor Build Run Tools Git Window Help
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INFO6205 – RandomWalk.java
INFO6205 src main java edu neu coe info6205 randomwalk RandomWalk randomWalk
RandomWalkTest.java
RandomWalk.java
Project
INFO6205 ~/Documents/GitHub/INFO6205
.idea
src
main
java
edu.neu.coe.info6205
balsearchtree
bqs
codelength
coupling
dynamicProgramming.coins
equable
functions
graphs
greedy
hashtable
lab_1
life
pq
randomwalk 100% classes, 72% lines cover
RandomWalk 83% methods, 72% lines co
reduction
runLengthEncoding
sort
symbolTable
threesum
union_find
util
BinarySearch
CallByValue
ComparableTuple
Counter
HuffmanCoding
Iteration
Matrix
MyDate
Mystery
NewtonApproximation
RecursionAndIteration
SizedIterable
* Perform a random walk of m steps
* @param m the number of steps the drunkard takes
1 usage
private void randomWalk(int m) {
//We are utilizing randomMove function which already moves the coordinates
for (int i = 0; i < m; i++) {
randomMove();
}
}
/**
* Private method to generate a random move according to the rules of the situation.
* That's to say, moves can be (+-1, 0) or (0, +-1).
*/
1 usage
private void randomMove() {
boolean ns = random.nextBoolean();
int step = random.nextBoolean() ? 1 : -1;
move(ns ? step : 0, ns ? 0 : step);
}
/**
* Method to compute the distance from the origin (the lamp-post where the drunkard starts) to his current position.
*
* @return the (Euclidean) distance from the origin to the current position.
*/
public double distance() {
//As the distance is asked from the origin we are not explicitly mentioning the origin coordinates
return Math.pow((Math.pow(x,2))+(Math.pow(y,2)),0.5);
}
/**
* Perform multiple random walk experiments, returning the mean distance.
*
* @param m the number of steps for each experiment
Coverage:
Element
edu.n 1... 8... 7...
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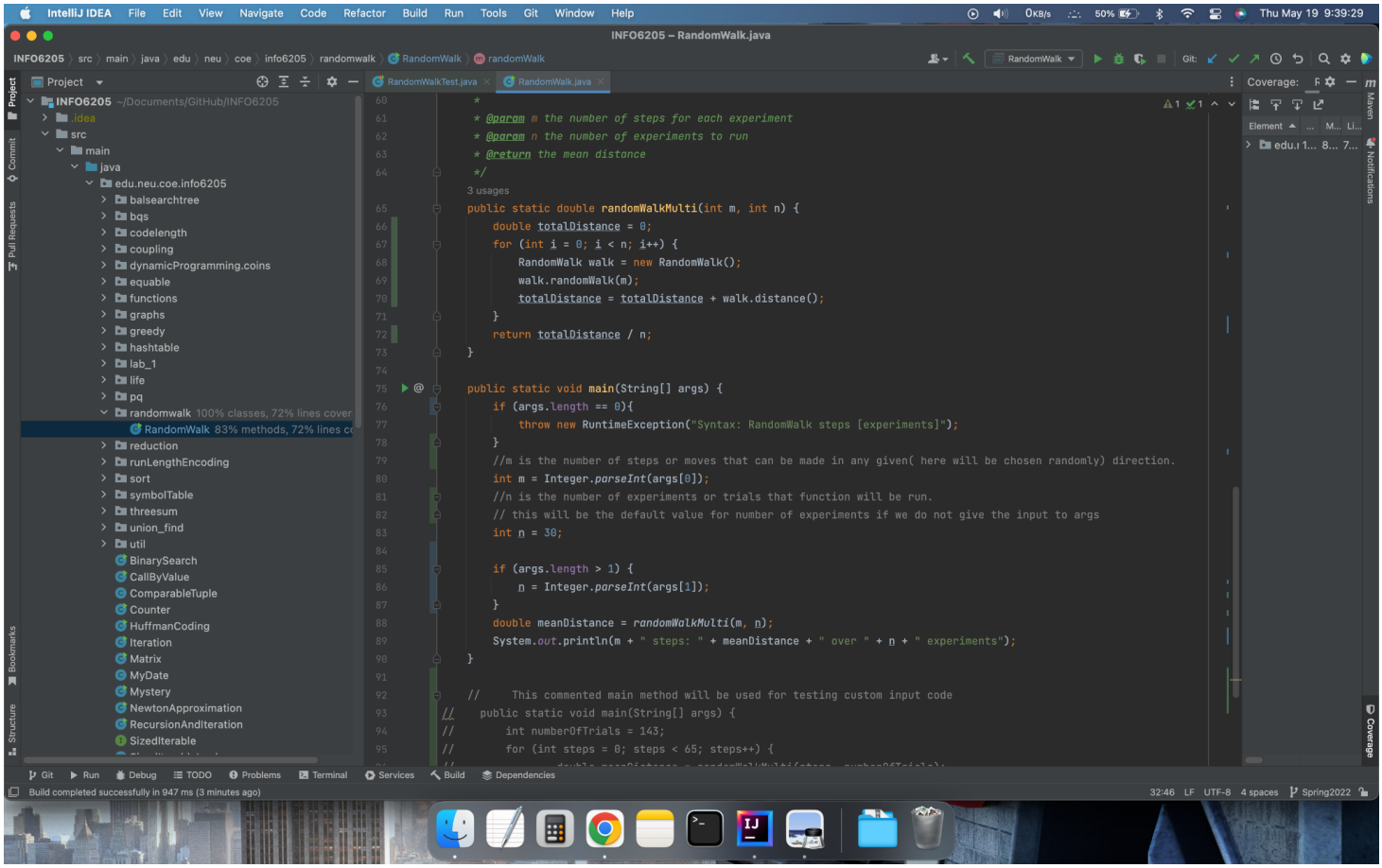
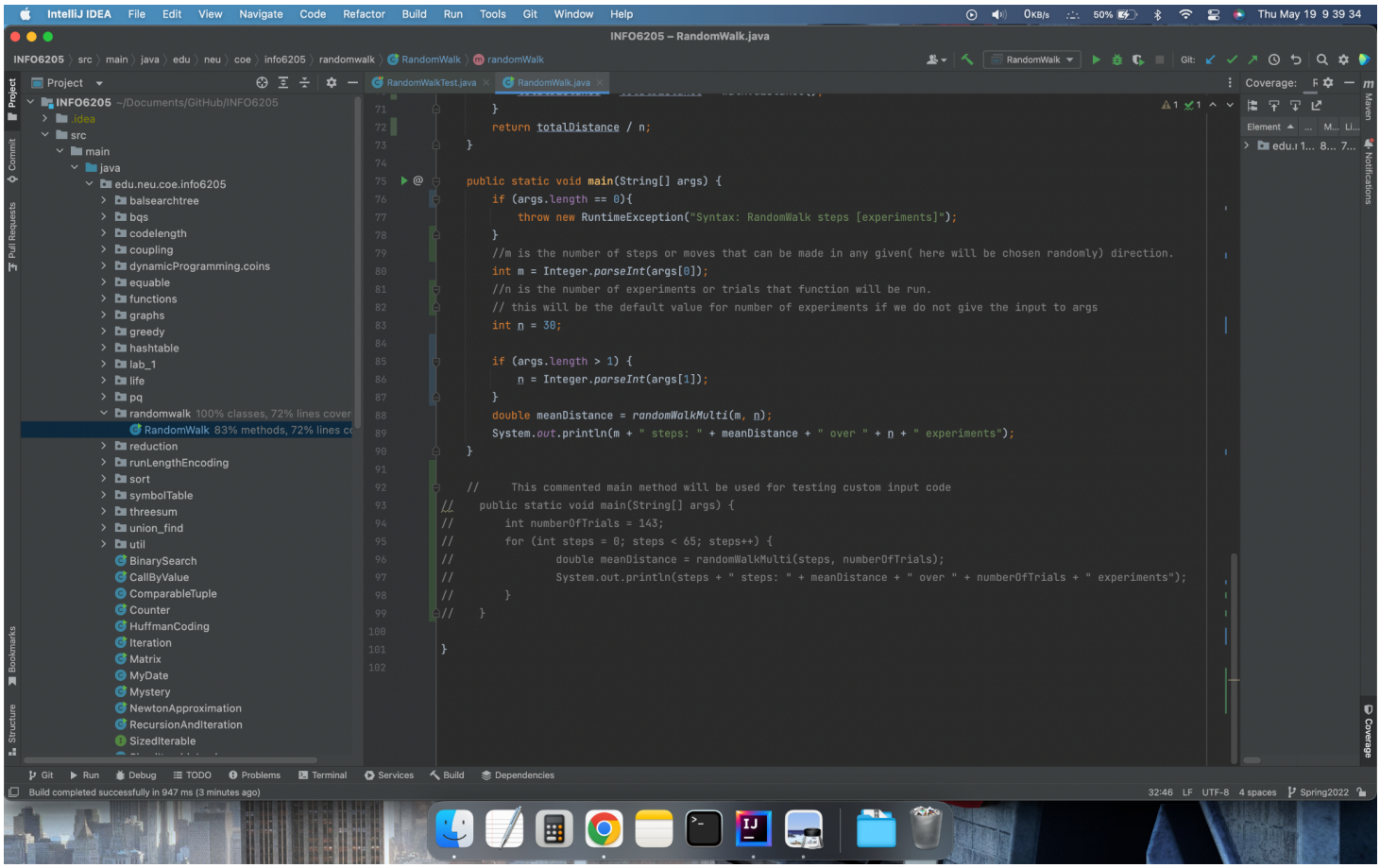
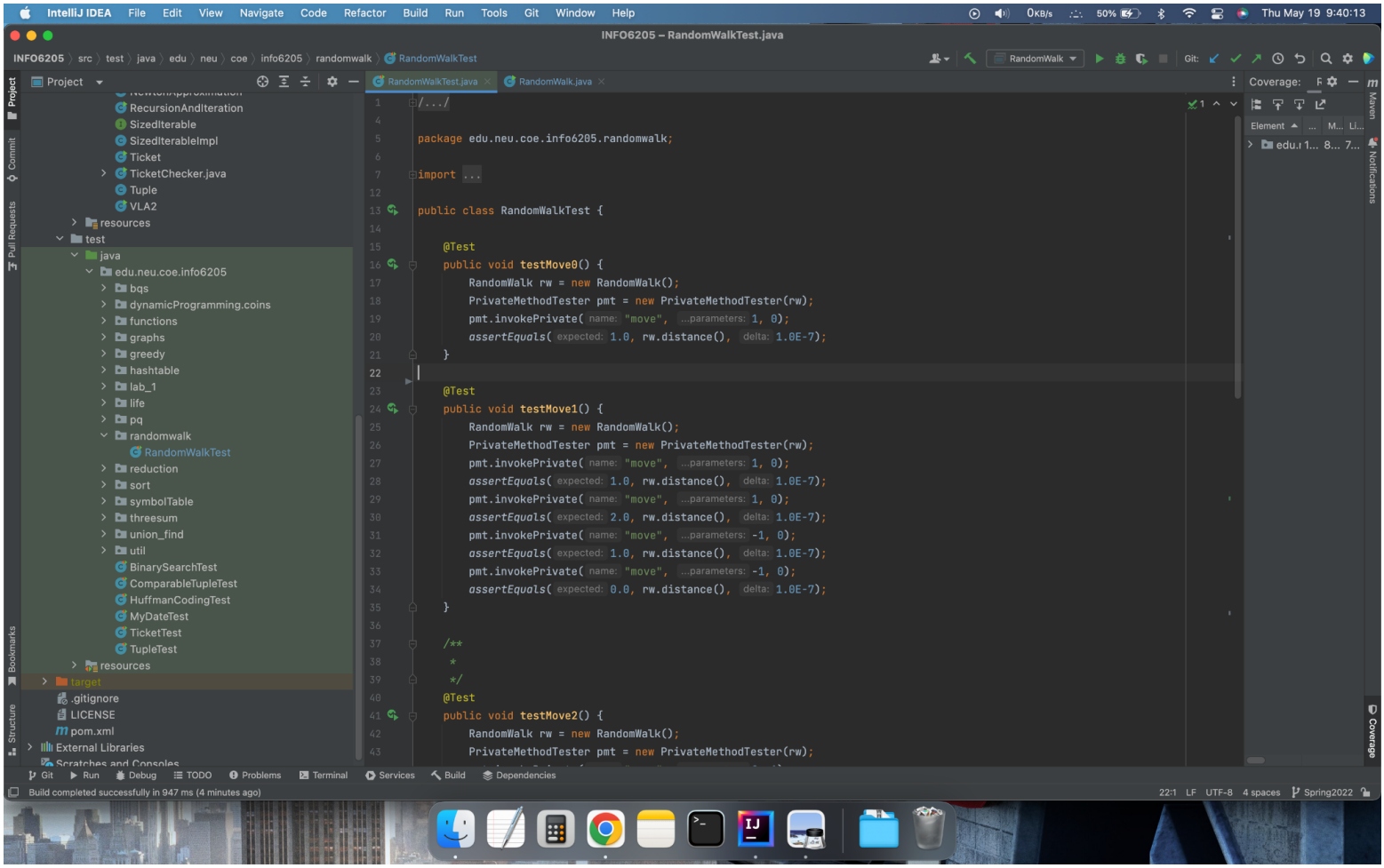
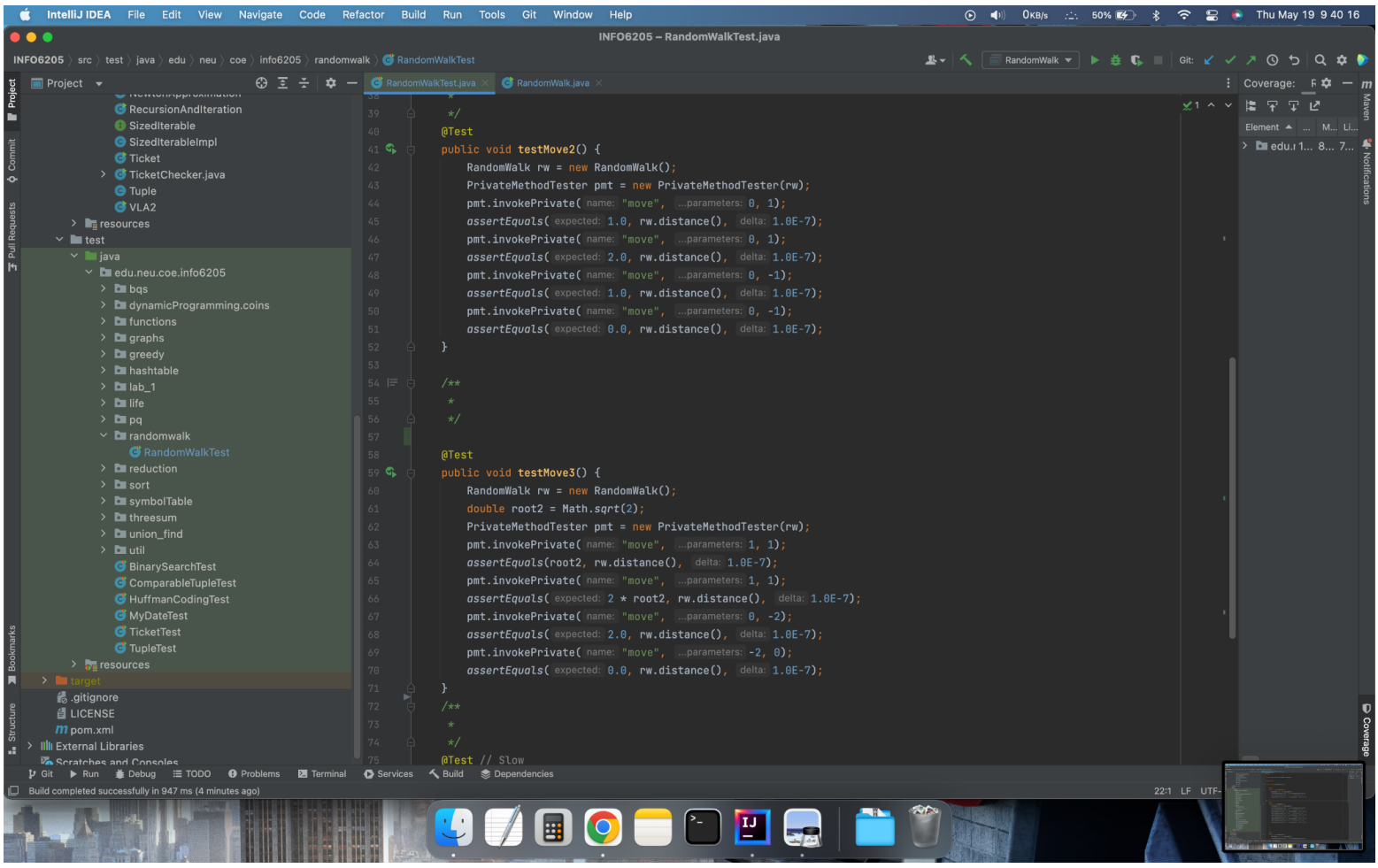


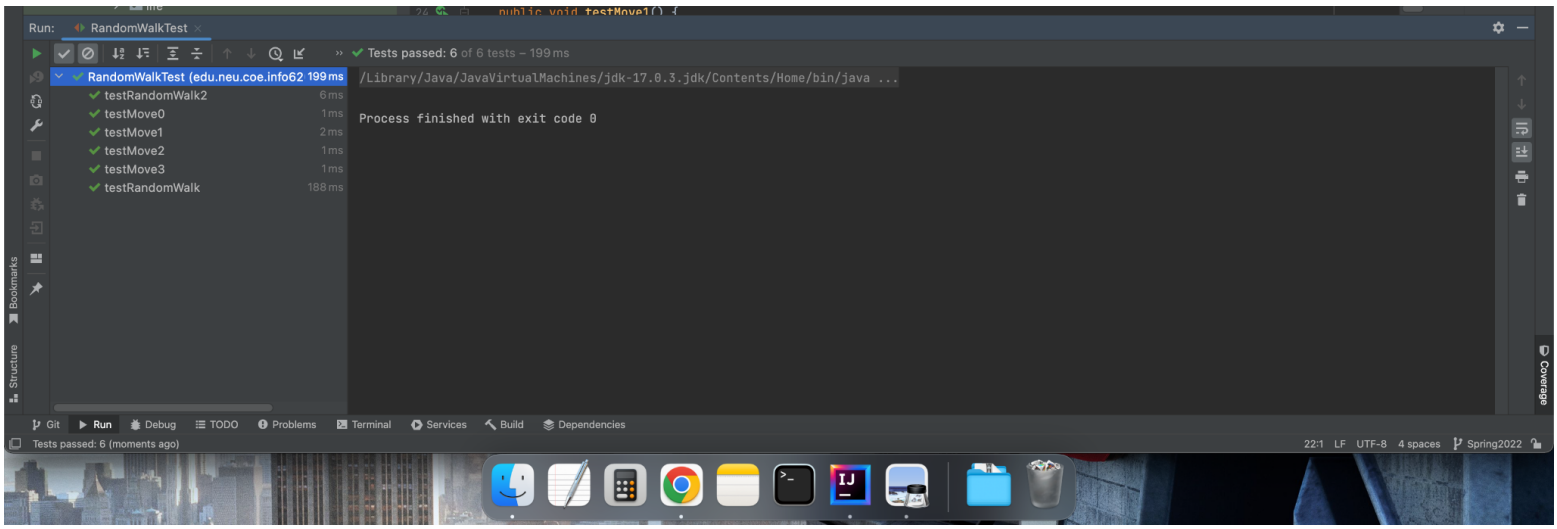


All Test Cases Are Running for the implemented code - Attached > Test Cases + Test Results

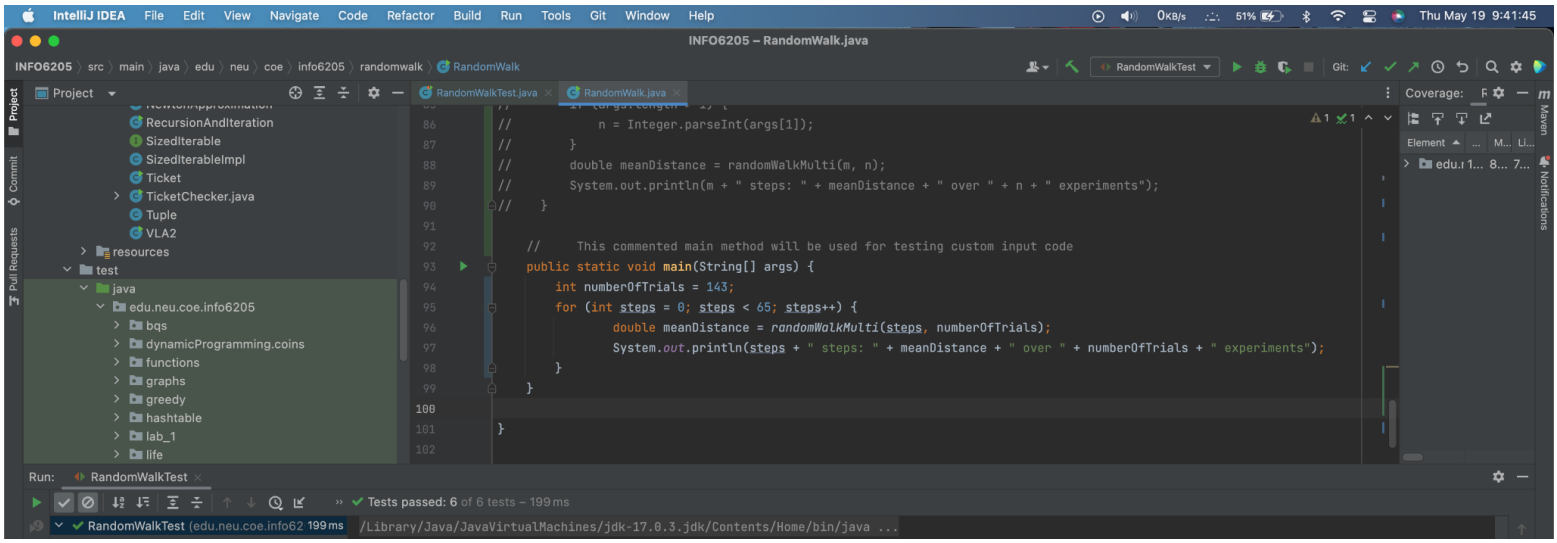




All Test Cases were passed

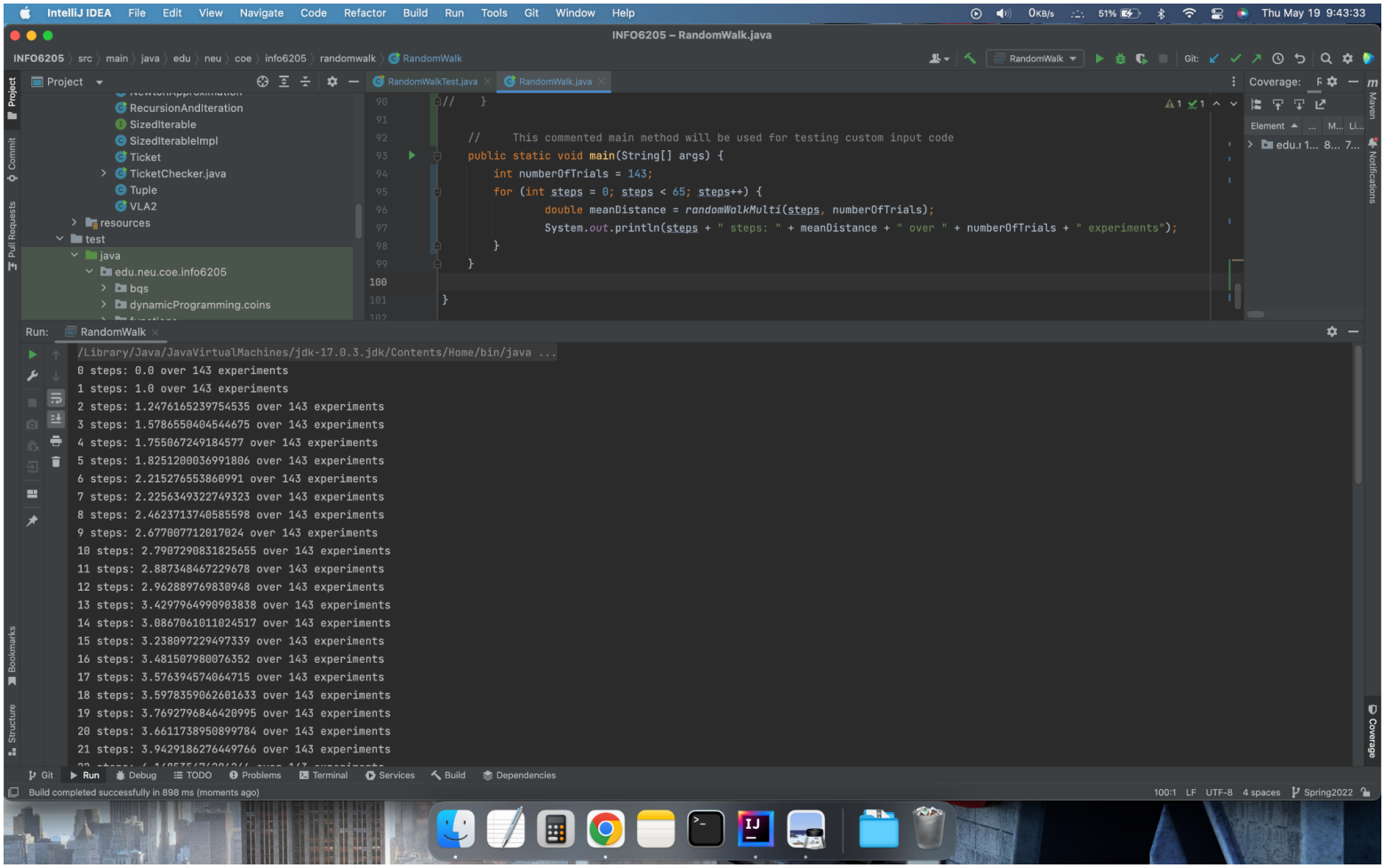


Modified Main Method to run custom test cases



Console Output of Main method with custom tests running for steps ranging from 0 to 65 and with each steps count running for 143 Trials (Arbitrarily chosen)

Attached are Excel Files with the data and also the curve showing the trend of the mean distance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SizedIterableImpl
Ticket
TicketChecker.java
Tuple
VLA2
resources
test
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bqs
dynamicProgramming.coins
Coverage:
// }
// This commented main method will be used for testing custom input code
public static void main(String[] args) {
int numberOfTrials = 143;
for (int steps = 0; steps < 65; steps++) {
double meanDistance = randomWalkMulti(steps, numberOfTrials);
System.out.println(steps + " steps: " + meanDistance + " over " + numberOfTrials + " experiments");
}
}
}
Run: RandomWalk
/Library/Java/JavaVirtualMachines/jdk-17.0.3.jdk/Contents/Home/bin/java ...
0 steps: 0.0 over 143 experiments
1 steps: 1.0 over 143 experiments
2 steps: 1.2476165239754535 over 143 experiments
3 steps: 1.5786550404544675 over 143 experiments
4 steps: 1.755067249184577 over 143 experiments
5 steps: 1.8251200036991806 over 143 experiments
6 steps: 2.215276553860991 over 143 experiments
7 steps: 2.2256349322749323 over 143 experiments
8 steps: 2.4623713740585598 over 143 experiments
9 steps: 2.677007712017024 over 143 experiments
10 steps: 2.7907290831825655 over 143 experiments
11 steps: 2.887348467229678 over 143 experiments
12 steps: 2.962889769830948 over 143 experiments
13 steps: 3.4297964990903838 over 143 experiments
14 steps: 3.0867061011024517 over 143 experiments
15 steps: 3.238097229497339 over 143 experiments
16 steps: 3.481507980076352 over 143 experiments
17 steps: 3.576394574064715 over 143 experiments
18 steps: 3.5978359062601633 over 143 experiments
19 steps: 3.7692796846420995 over 143 experiments
20 steps: 3.6611738950899784 over 143 experiments
21 steps: 3.9429186276449766 over 143 experiments
Git Run Debug TODO Problems Terminal Services Build Dependencies
Build completed successfully in 898 ms (moments ago)
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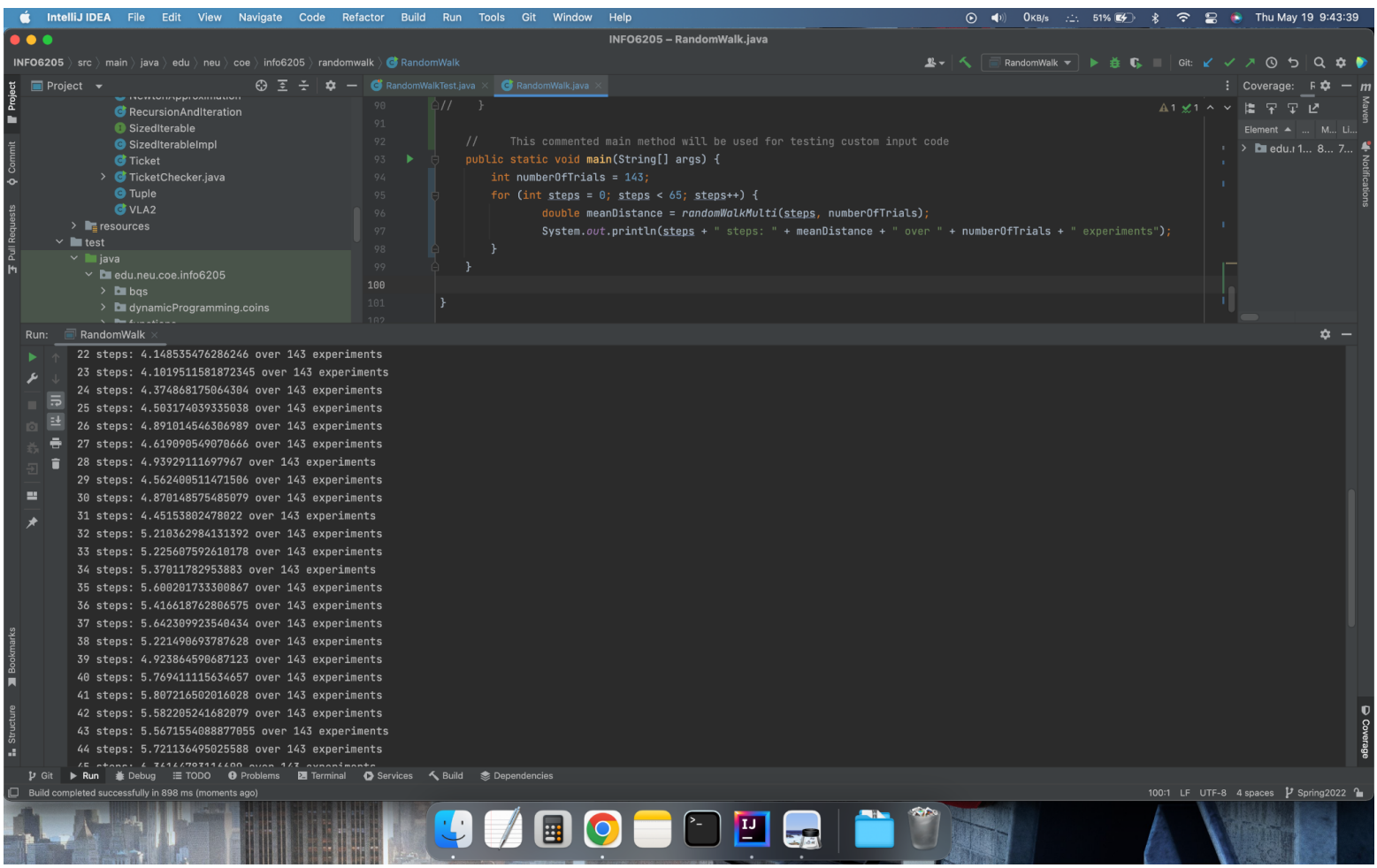
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System.out.println(steps + " steps: " + meanDistance + " over " + numberOfTrials + " experiments");
}
}
}
Run: RandomWalk
22 steps: 4.148535476286246 over 143 experiments
23 steps: 4.1019511581872345 over 143 experiments
24 steps: 4.374868175064304 over 143 experiments
25 steps: 4.503174039335038 over 143 experiments
26 steps: 4.891014546306989 over 143 experiments
27 steps: 4.619090549070666 over 143 experiments
28 steps: 4.93929111697967 over 143 experiments
29 steps: 4.562400511471506 over 143 experiments
30 steps: 4.870148575485079 over 143 experiments
31 steps: 4.45153802478022 over 143 experiments
32 steps: 5.210362984131392 over 143 experiments
33 steps: 5.225607592618178 over 143 experiments
34 steps: 5.37011782953883 over 143 experiments
35 steps: 5.600201733300867 over 143 experiments
36 steps: 5.416618762806575 over 143 experiments
37 steps: 5.642309923540434 over 143 experiments
38 steps: 5.221490693787628 over 143 experiments
39 steps: 4.923864590687123 over 143 experiments
40 steps: 5.769411115634657 over 143 experiments
41 steps: 5.807216502016028 over 143 experiments
42 steps: 5.582205241682079 over 143 experiments
43 steps: 5.5671554088877055 over 143 experiments
44 steps: 5.721136495025588 over 143 experiments
Git Run Debug TODO Problems Terminal Services Build Dependencies
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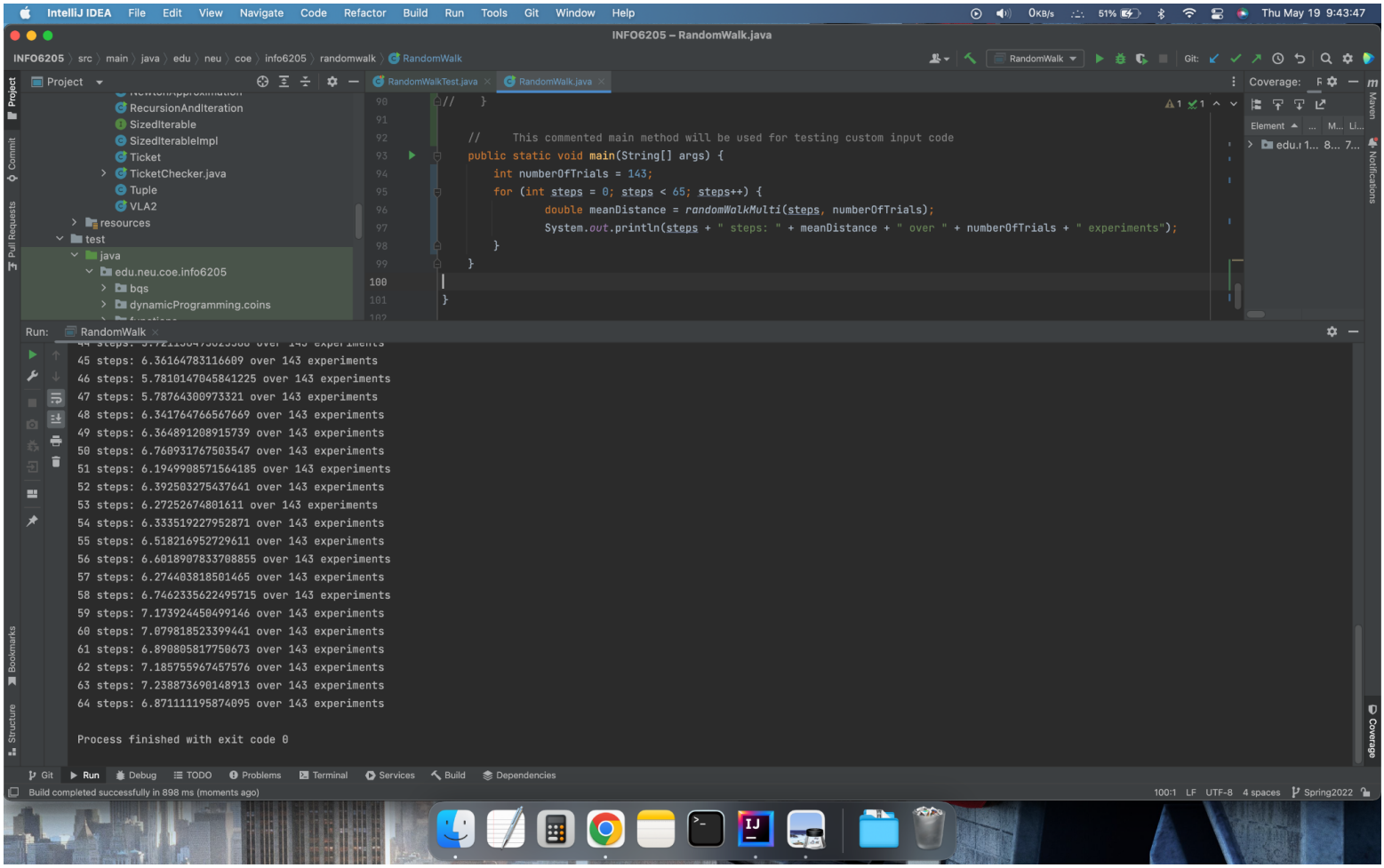
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System.out.println(steps + " steps: " + meanDistance + " over " + numberOfTrials + " experiments");
}
}
}
Run: RandomWalk
45 steps: 6.36164783116609 over 143 experiments
46 steps: 5.7810147045841225 over 143 experiments
47 steps: 5.78764300973321 over 143 experiments
48 steps: 6.341764766567669 over 143 experiments
49 steps: 6.364891208915739 over 143 experiments
50 steps: 6.760931767503547 over 143 experiments
51 steps: 6.1949908571564185 over 143 experiments
52 steps: 6.392503275437641 over 143 experiments
53 steps: 6.27252674801611 over 143 experiments
54 steps: 6.333519227952871 over 143 experiments
55 steps: 6.518216952729611 over 143 experiments
56 steps: 6.6018907833708855 over 143 experiments
57 steps: 6.274403818501465 over 143 experiments
58 steps: 6.7462335622495715 over 143 experiments
59 steps: 7.173924450499146 over 143 experiments
60 steps: 7.079818523399441 over 143 experiments
61 steps: 6.890805817750673 over 143 experiments
62 steps: 7.185755967457576 over 143 experiments
63 steps: 7.238873690148913 over 143 experiments
64 steps: 6.871111195874095 over 143 experiments
Process finished with exit code 0
Git Run Debug TODO Problems Terminal Services Build Dependencies
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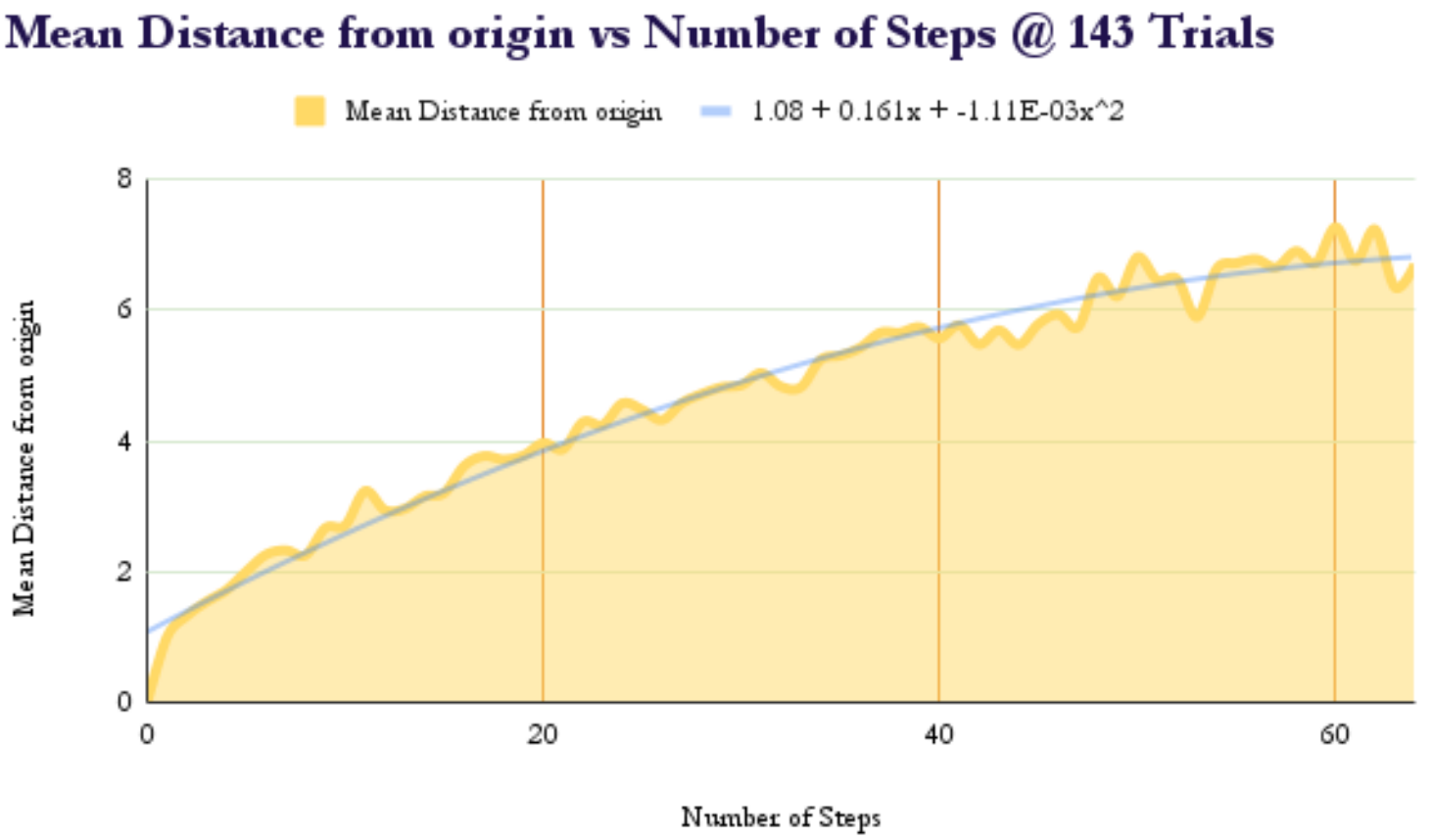
Mean Distance from origin vs Number of Steps @ 143 Trials
Mean Distance from origin
1.08 + 0.161x + -1.11E-03x^2
Mean Distance from origin
Number of Steps
0
2
4
6
8
0
20
40
60

Excel File

Assignment 01 Data

Conclusion

The mean distance showed a growth in small increments for the experiments run from 0 to 65 steps and each step running for 143 trials. From the graph above the trend also appears follows a curve

$$y = 1.08 + (0.161)(x) + (-1.11E-03)(x^2)$$

which is a second degree quadratic equation