Lab 2 Report

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1 Test Plan

1.1 Test requirements

The Lab 2 requires to (1) select 19 methods from 6 classes of the SUT (GeoProject), (2) design Unit test cases by using **input space partitioning (ISP)** technique for the selected methods, (3) develop test scripts to implement the test cases, (4) execute the test scripts on the selected methods, (5) report the test results, and (6) specify your experiences of designing test cases systematically using the ISP technique.

In particular, based on the statement coverage criterion, the **test requirements** for Lab 2 are to design test cases *with **ISP*** for each selected method so that "*each statement of the method will be covered by at least one test case* and *the minimum statement coverage is 70% (greater than Lab 1)*".

1.2 Test Strategy

To satisfy the test requirements listed in Section 1, a proposed strategy is to

(1) select **those 10 methods that were chosen in Lab1** and **5 new methods** that are NOT selected previously. If possible, some of the methods do NOT have primitive types of input or output parameters (if possible).

(2) set the objective of the minimum statement coverage to be greater than that of Lab 1 and adjust the test objective based on the time available (if necessary).

(3) design the test cases for those selected methods by using the **input space partitioning (ISP)** technique.

1.3 Test activities

To implement the proposed strategy, the following activities are planned to perform.

No.	Activity Name	Plan hours	Schedule Date
1	Study GeoProject	5	2020/04/15
2	Learn **ISP** and JUnit	4	2020/04/15~04/18
3	Design test cases for the selected methods	8	2020/04/16~04/18
4	Implement test cases	8	2020/04/17~04/18

5	Perform tests	4	2020/04/18
6	Complete Lab2 report	2	2020/04/22

1.4 Design Approach

The **ISP** technique will be used to design the test cases. Specifically, the possible partitions and boundary values of input parameters shall be identified first using the **Mine Map** and **domain knowledge** (if applicable). The possible **valid** combinations of the partitions (i.e., **all combination coverage**) as well as the boundary values shall be computed for the input parameters of each selected method. Each of the partition combination can be a possible test case. *Add more test cases by considering the possible values and boundary of the outputs for the methods or by using test experiences.*

1.5 Success criteria

All test cases designed for the selected methods must pass and *the statement coverage should have achieved at least 70%.*

2 Test Design

To fulfill the test requirements listed in section 1.1, the following methods are selected and corresponding test cases are designed.

No.	Class	Method	Test Objective	Inputs	Expected Outputs
1	Base32	encodeBase32(long l, int length)	將 long 值以 Base32 進行編碼, 答案長度以 length 控制	(-10, 5)	-0000b
2	Base32	encodeBase32(long i)	將 long 值以 Base32 進行編碼	-10	-00000000000b
3	Base32	decodeBase32(String hash)	將 hash 值解碼為 long 值	-29jw	-75324

4	Base32	getCharIndex(char ch)	取得輸入字元為 base32 索引中第幾個	b	10
5	Base32	padLeftWithZerosToLength(String s, int length)	將 s 左邊補零到指定長度	1234, 6	001234
6	CoverageLongs	getHashes()	取得 hashes	CoverageLongs({5, 9, 1}, count=3, ratio=1.2)	{5, 9, 1}
7	CoverageLongs	getRatio()	取得指定區域中 hash 所占區域比例	CoverageLongs({5, 9, 1}, count=3, ratio=1.2)	1.2
8	CoverageLongs	getHashLength()	取得在 hash set 中第一個字元所代表的長度	CoverageLongs({5, 9, 1}, count=1, ratio=1.2)	5
9	CoverageLongs	getCount()	取得 count	CoverageLongs({5, 9, 1}, count=1, ratio=1.2)	1
10	GeoHash	adjacentHash(String hash, Direction direction)	取得指定方向的 hash 的鄰居	dg, right	e5
11	GeoHash	right(String hash)	取得 hash 的右鄰居	dg	E5
12	GeoHash	left(String hash)	取得 hash 的左鄰居	d4	9f
13	GeoHash	top(String hash)	取得 hash 的上	dx	f8

			鄰居		
14	GeoHash	bottom(String hash)	取得 hash 下鄰居	d2	6r
15	GeoHash	adjacentHash(String hash, Direction direction, int steps)	取得 hash 的指定方向的 steps 格遠的鄰居	d2, bottom, 2	6q
16	GeoHash	neighbours(String hash)	取得 hash 附近的 8 個鄰居	d2	<"d0", "d8", "d3", "6r", "d1", "6p", "d9", "6x">
17	GeoHash	encodeHash(double latitude, double longitude)	利用經緯度轉換出長度為 12 的 GeoHash	50, 50	v0gs3y0zh7w1
18	GeoHash	encodeHash(LatLong p, int length)	利用經緯度轉換出指定長度的 GeoHash	50, 50, 12	v0gs3y0zh7w1
19	GeoHash	encodeHash(LatLong p)	利用經緯度轉換出長度為 12 的 GeoHash	LatLong(50, 50)	v0gs3y0zh7w1

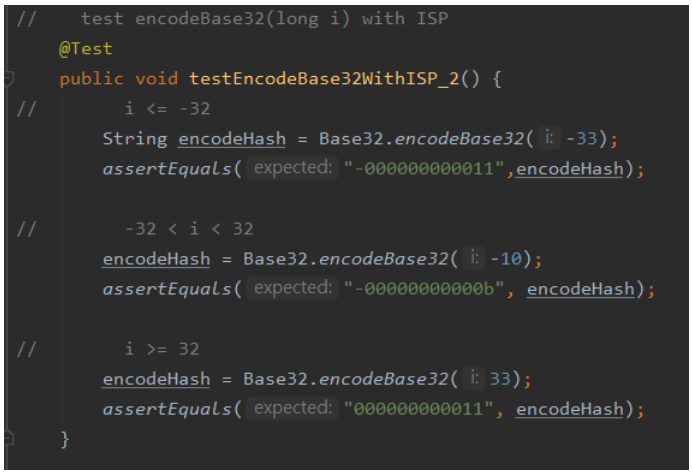
The details of the design are given below:

The Excel file of test cases…

3 Test Implementation

The design of test cases specified in Section 2 was implemented using JUnit 4. The test scripts of 3 selected test cases are given below. The rest of the test script

implementations can be found in the link (or JUnit files).

No.	Test method	Source code
1	testEncodeBase32WithISP_2()	
2	testGetCharIndexWithISP()	
3	testPadLeftWithZerosToLengthWithISP()	

4 Test Results

4.1 JUnit test result snapshot

Test Summary

57	0	0	0.272s
tests	failures	ignored	duration

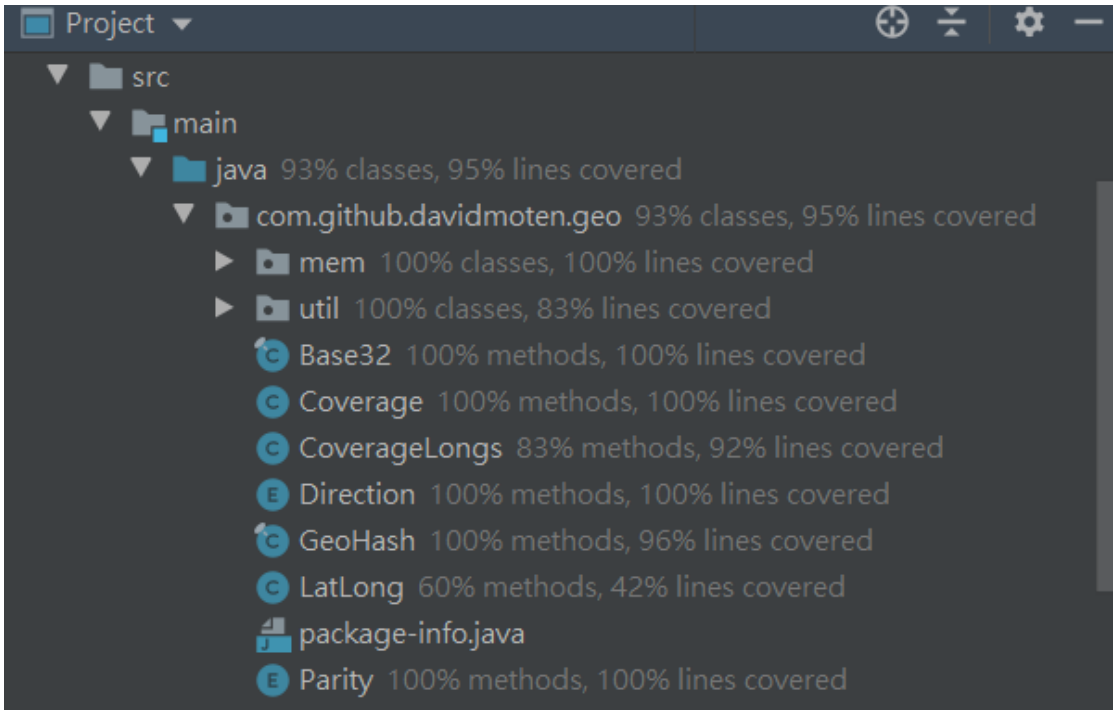
100% successful

Packages | Classes

Package	Tests	Failures	Ignored	Duration	Success rate
com.github.davidmoten.geo	50	0	0	0.166s	100%
com.github.davidmoten.geo.mem	7	0	0	0.106s	100%

4.2 Code coverage snapshot

- Coverage of each selected method



- Total coverage

geo

Element	Missed Instructions	Cov.	Missed Branches	Cov.	Missed	Cxty	Missed	Lines	Missed	Methods	Missed	Classes
com.github.davidmoten.geo		94%		90%	19	149	18	348	3	68	0	10
com.github.davidmoten.geo.util		68%		75%	1	4	1	6	0	2	0	1
com.github.davidmoten.geo.mem		99%		75%	5	30	0	61	0	20	0	3
Total	118 of 2,326	94%	22 of 186	88%	25	183	19	415	3	90	0	14

4.3 CI result snapshot (3 iterations for CI)

- CI#1

- CI#2

- CI#3

- CI Pipeline

5 Summary

In Lab 2, **19 test cases have been designed and implemented using JUnit and the ISP technique**. The test is conducted in 3 CI and **the execution results of the 15 test methods are all passed**. **The total statement coverage of the test is 70%.** Thus, the test requirements described in Section 1 are satisfied.