Lab 2 Report

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1 Test Plan

1.1 Test requirements

The Lab 2 requires to (1) select 15 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	1	2019/3/26
2	Learn **ISP** and JUnit	1	2019/3/26
3	Design test cases for the selected methods	2	2019/3/27
4	Implement test cases	3	2019/3/28

5	Perform tests	1	2019/3/29
6	Complete Lab2 report	1	2019/3/30

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 (or 90% of all test cases 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.

The details of the design are given below:
The Excel file of test cases…

No.	Class	Method	Test Objective	Inputs	Expected Outputs
1	Base32	encodeBase32	encodeBase32(long i, int length)	i = -75314, length = -6	"-29jk"
				i = -89563, length = 1	"-2rfv"
				i = 66666, length = -8	"213b"
				i = 88888, length = 7	"0002qts"
2	Base32	decodeBase32	decodeBase32(String hash)	hash = 29jw	75324
				hash = -29jk	-75314
3	Base32	getCharIndex	getCharIndex(char ch)	ch = 'b'	10
				ch = 'a'	“not a base32 character: a”
4	Base32	encodeBase32	encodeBase32(long i)	i = -6666	"-0000000006hb"
				i = 75324	"0000000029jw"
5	GeoHash	top	top(String hash)	hash = "-29xy"	"-2c8n"
				hash = "29jw"	"29jx"
6	GeoHash	bottom	bottom (String hash)	hash = "-30xx"	"-30xr"
				hash = "88eq"	"88em"
7	GeoHash	left	left (String hash)	hash = "-32ty"	"-32tv"
				"66py"	"66pw"
8	GeoHash	right	right (String hash)	hash = "-00er"	"-00g2"
				hash = "68jk"	"68js"
9	GeoHash	heightDegrees	heightDegrees(int n)	n = 2	5.625
				ch = 14	5.24E-09
10	GeoHash	widthDegrees	widthDegrees(int n)	n = 13	5.4.190951585769653E-8
				n = 6	1.10E-02
11	GeoHash	hashLengthToCoverBoundingBox	hashLengthToCoverBoundingBox(double topLeftLat,	topLeftLat = 25.0361156, topLeftLon = 121.4639264,	4

			double topLeftLon, double bottomRightLat, double bottomRightLon)	bottomRightLat = 25.0289061, bottomRightLon = 121.4889208	
				topLeftLat = 25.0289061, topLeftLon = 121.4889208, bottomRightLat = 25.0361156, bottomRightLon = 121.4639264	4
				opLeftLat = 0, topLeftLon = 0, bottomRightLat = 0, bottomRightLon = 0	12
12	GeoHash	adjacentHash	adjacentHash(String hash, Direction direction)	hash = null, directioh: Direction.LEFT	"hash must be non-null"
				hash = "19jw", directioh: Direction.LEFT	"19jq"
13	GeoHash	decodeHash	decodeHash(String geohash)	geohash = null	"geohash cannot be null"
				geohash = "29jw"	LatLong<LatLong [lat=-38.232421875, lon=-

					149.58984375]>
14	GeoHash	encodeHash	encodeHash(LatLong p, int length)	p = new LatLong(-38.232421875, -149.58984375), length = 6	"29jws0"
				p = new LatLong(-38.232421875, -149.58984375), length = 0	"length must be greater than zero"
15	GeoHash	hashContains	hashContains(String hash, double lat, double lon)	hash = 29jw, lat = -38.232421875, lon = -149.58984375	TRUE
				hash = 29jw, lat = 0, lon = 0	FALSE

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	GeoHash.decodeHash(String geohash)	@Test
		public void decodeHash() throws Exception{
		LatLong result = GeoHash.decodeHash("29jw");
		LatLong ll = new LatLong(-38.232421875, -149.58984375);
		assertEquals(ll.getLat(), result.getLat(),0.001);
		assertEquals(ll.getLon(), result.getLon(),0.001);

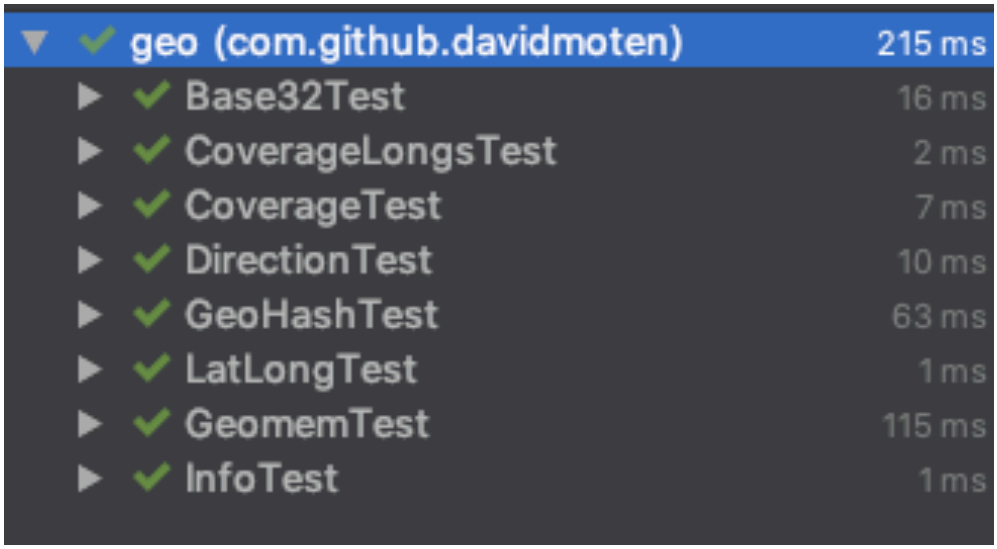
		}

2	GeoHash.hashContains(String hash, double lat, double lon)	@Test
		public void coverBoundingBox() throws Exception{
		Boolean result = GeoHash.hashContains("29jw",
		-38.232421875, -149.58984375);
		assertEquals(true, result);
		}

3	GeoHash.widthDegrees(int n)	@Test
		public void widthDegrees_F() throws Exception{
		double n = GeoHash.widthDegrees(13);
		assertEquals(4.190951585769653E-8,n,0.001);
		}

4 Test Results

4.1 JUnit test result snapshot



Test Summary

57 tests	0 failures	0 ignored	0.232s duration	100% successful

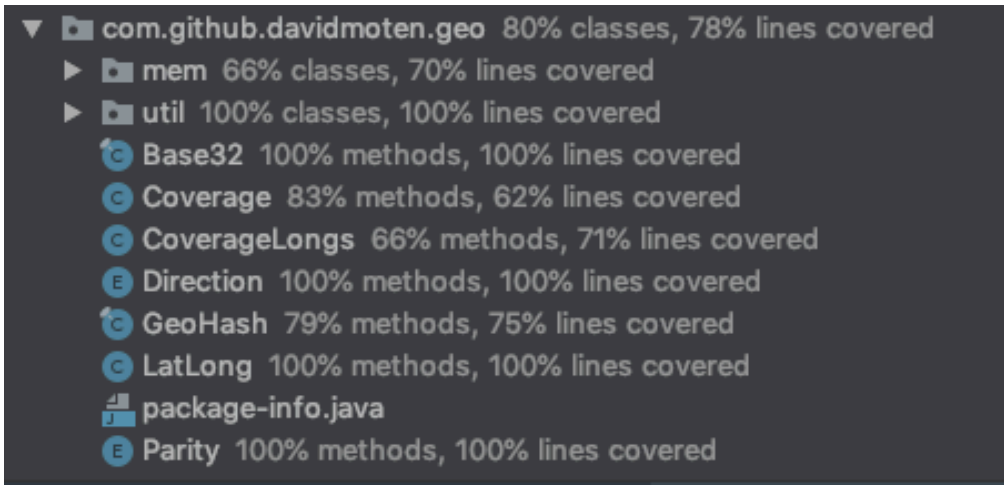
Packages | Classes

Package	Tests	Failures	Ignored	Duration	Success rate
com.github.davidmoten.geo	50	0	0	0.145s	100%
com.github.davidmoten.geo.mem	7	0	0	0.087s	100%

Generated by Gradle 3.4 at 2019/3/30 上午 12:02:53

4.2 Code coverage snapshot

- Coverage of each selected method



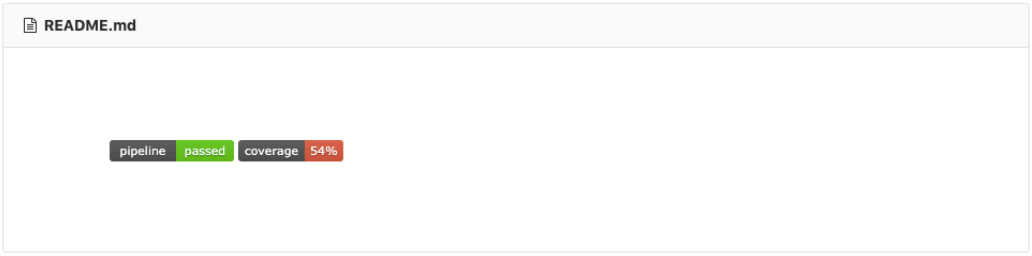
- Total coverage

geo

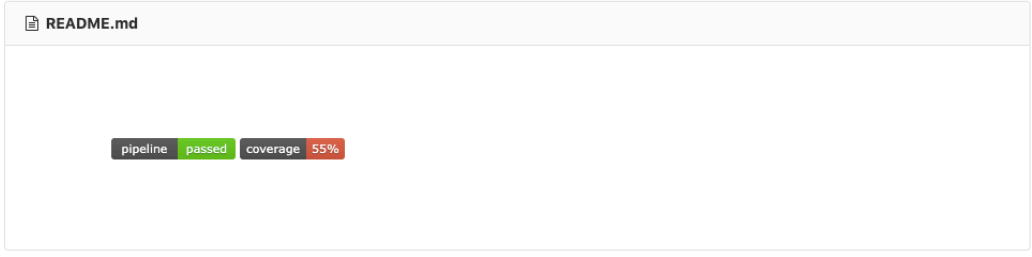
Element	Missed Instructions	Cov.	Missed Branches	Cov.	Missed	Cxty	Missed	Lines	Missed	Methods	Missed	Classes
com.github.davidmoten.geo		78%		70%	39	149	70	348	10	68	1	10
com.github.davidmoten.geo.mem		62%		30%	14	30	17	61	6	20	1	3
com.github.davidmoten.geo.util		100%		100%	0	4	0	6	0	2	0	1
Total	550 of 2,326	76%	61 of 186	67%	53	183	87	415	16	90	2	14

4.3 CI result snapshot (3 iterations for CI)

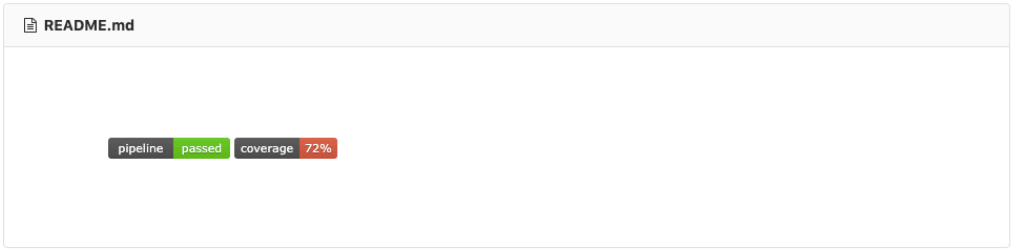
- CI#1



- CI#2



- CI#3



- CI Pipeline

Status	Pipeline	Commit	Stages	
passed	#1027 by latest	master 00eab9f2 Lab2_4		00:01:05 about 15 hours ago
passed	#1016 by	master 31ee6535 Lab2_3		00:01:01 a day ago
passed	#1004 by	master 5c653410 Lab2_2		00:01:07 3 days ago
passed	#1003 by	master 69806d27 Lab2_1		00:01:07 3 days ago

5 Summary

相較 Lab1，在設計 test case 時須考量到較多面向，不只是為了提高 statement coverage 而寫 happy path，對同一個 method 會花更多間在設計，雖然不見得會提高覆蓋率，但在品質方面相對有保障。