

CS608

Software Testing

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Lectures: 9-12

Labs: 2-4

Lab 3 Review Tutorial

- Develop BVA tests for:
- `int Insurance.premium(int age, Status ncb, boolean lowRisk)`
- Take notes of key points
- View the correct answers on Moodle

The basic cost of an insurance premium for drivers is EUR 500

This premium can increase or decrease depending on: age, no-claims-bonus, and occupation

a) There is an premium increase of EUR 1500 for drivers that are below the age of 25

b) There is a premium reduction of EUR 200 for drivers who are at least 25, have an ncb, and:

- have a low risk occupation

and/or

- are less than 45 years old

Drivers **younger than 16** or **older than 65** will not be insured

@param age - age of person to be insured

@param ncb - no claims bonus status

@param lowRisk - true if have a low risk occupation

@return

500 - base insurance premium

2000 - premium for drivers **less than 25**

300 - premium for drivers who are **at least 25**, have an ncb and a low risk occupation

300 - premium for drivers who are at least 25, have an ncb and are **less than 45** years old

0 - are not eligible for insurance

-1 - invalid inputs (**invalid age** or ncb not stated)

REMINDER: Specification-Based Ranges

- **age:** [Integer.MIN_VALUE ✓ .. -1 ✓][0 ✓ .. 15 ✓][16 ✓ .. 24 ✓][25 ✓ .. 44 ✓][45 ✓ .. 65 ✓][66 ✓ .. Integer.MAX_VALUE ✓]
- **ncb:** [YES ✓] [NO ✓] [NOT_STATED ✓]
- **lowRisk:** [true ✓] [false ✓]
- **Return Value:** [-1 ✓][0 ✓][300 ✓][500 ✓][2000 ✓]

Test Coverage Items

TCI	Error (Y/N)	Parameter	Boundary Value	Test Case
BV1	Y	age	Integer.MIN_VALUE	T2.11
BV2	Y		-1	T2.12
BV3	N		0	T2.1
BV4	N		15	T2.2
BV5	N		16	T2.3
BV6	N		24	T2.4
BV7	N		25	T2.5
BV8	N		44	T2.6
BV9	N		45	T2.7
BV10	N		65	T2.10
BV11	N		66	T2.8

BV11	N		66	T2.8
BV12	N		Integer.MAX_VALUE	T2.9
BV13	N	ncb	YES	T2.1
BV14	N		NO	T2.2
BV15	Y		NOT_STATED	T2.13
BV16	N	lowRisk	true	T2.1
BV17	N		false	T2.2
BV18		Return Value	-1	T2.11
BV19			0	T2.1
BV20			300	T2.10
BV21			500	T2.5
BV22			2000	T2.3

Test Cases

ID	TCI Covered	Input: age	Input: ncb	Input: lowRisk	Exp. Results: return value
T2.1	BV3,13,16,19	0	YES	true	0
T2.2	BV4,14,17,[19]	15	NO	false	0
T2.3	BV5,[14],[17],22	16	NO	false	2000
T2.4	BV6,[14],[17],[22]	24	NO	false	2000
T2.5	BV7,[14],[17],21	25	NO	false	500
T2.6	BV8,[14],[17],[21]	44	NO	false	500
T2.7	BV9,[14],[17],[21]	45	NO	false	500
T2.8	BV11,[14],[17],[19]	66	NO	false	0
T2.9	BV12,[14],[17],[19]	Integer.MAX_VALUE	NO	false	0
T2.10	BV10,[13],[16],20	65	YES	true	300
T2.11	BV1*,18	Integer.MIN_VALUE	NO	false	-1
T2.12	BV2*,[18]	-1	NO	false	-1
T2.13	BV15*,[18]	Integer.MAX_VALUE	NOT_STATED	false	-1

Review your work

- Question 1: is every test coverage item covered by a test case?
- Question 2: does every new test case cover at least one new test coverage item?

yes

yes

TCI	Error (Y/N)	Parameter	Boundary Value	Test Case
BV1	Y	age	Integer.MIN_VALUE	T2.11
BV2	Y		-1	T2.12
BV3	N		0	T2.1
BV4	N		15	T2.2
BV5	N		16	T2.3
BV6	N		24	T2.4
BV7	N		25	T2.5
BV8	N		44	T2.6
BV9	N		45	T2.7
BV10	N		65	T2.10
BV11	N		66	T2.8

BV11	N		66	T2.8
BV12	N		Integer.MAX_VALUE	T2.9
BV13	N	ncb	YES	T2.1
BV14	N		NO	T2.2
BV15	Y		NOT_STATED	T2.13
BV16	N	lowRisk	true	T2.1
BV17	N		false	T2.2
BV18		Return Value	-1	T2.11
BV19			0	T2.1
BV20			300	T2.10
BV21			500	T2.5
BV22			2000	T2.3

ID	TCI Covered	Input: age	Input: ncb	Input: lowRisk	Exp. Results: return value
T2.1	BV3,13,16,19	0	YES	true	0
T2.2	BV4,14,17,[19]	15	NO	false	0
T2.3	BV5,[14],[17],22	16	NO	false	2000
T2.4	BV6,[14],[17],[22]	24	NO	false	2000
T2.5	BV7,[14],[17],21	25	NO	false	500
T2.6	BV8,[14],[17],[21]	44	NO	false	500
T2.7	BV9,[14],[17],[21]	45	NO	false	500
T2.8	BV11,[14],[17],[19]	66	NO	false	0
T2.9	BV12,[14],[17],[19]	Integer.MAX_VALUE	NO	false	0
T2.10	BV10,[13],[16],20	65	YES	true	300
T2.11	BV1*,18	Integer.MIN_VALUE	NO	false	-1
T2.12	BV2*,[18]	-1	NO	false	-1
T2.13	BV15*,[18]	Integer.MAX_VALUE	NOT_STATED	false	-1

TEST IMPLEMENTATION

Test Cases

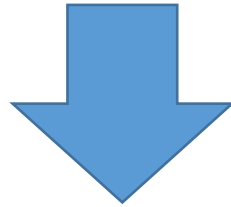
ID	TCI Covered	Input: age	Input: ncb	Input: lowRisk	Exp. Results: return value
T2.1	BV3,13,16,19	0	YES	true	0

```
// EP test data
private static Object[][] testData1 = new Object[][] {
    // test, bonuspoints, goldCustomer, expected output {
    ...
    "T2.1",    0, Status.YES,    true,    0 },
    ...
};
```

Fault2

- Do your tests find fault2?

```
// Check if uninsurable  
if (age<16 || age>65)  
    p=0;
```

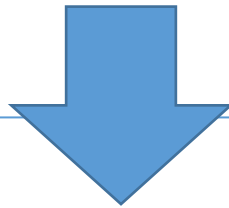


```
// Check if uninsurable  
if (age<16 || age>100) // fault2 - change boundary value  
    p=0;
```

Fault3

- Do your tests find fault3?

```
else {  
    p=500;  
    if (age<25)  
        p += 1500;  
    else if ((age<45 || lowRisk) && ncb==Status.YES)  
        p -= 200;  
}
```



```
if (age<25 && ncb!=Status.YES) // fault 3
```