CS608
Software Testing

Dr. Stephen Brown

Room Eolas 116

stephen.brown@mu.ie

Lab 2 Review Tutorial

- Develop EP tests for:
- int Insurance.premium(int age, Status ncb, boolean lowRisk)

- Take notes of key points
- View the correct answers on Moodle

!! READ THE LAB NOTES !!

- For equivalence values (in this assignment):
- For a short range, select the center value (round down)
- For a long range, use 5000/-5000 as large positive/negative numbers
- Enter a number, not a formula
- Don't use exponent form (e.g. 2.0E+10)
- Use symbolic constants where needed (such as **Integer.MAX_VALUE**), but not equations using them
- When removing duplicates do NOT reorder your test cases, but DO update (or enter) the ID’s so they are in numeric order.

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

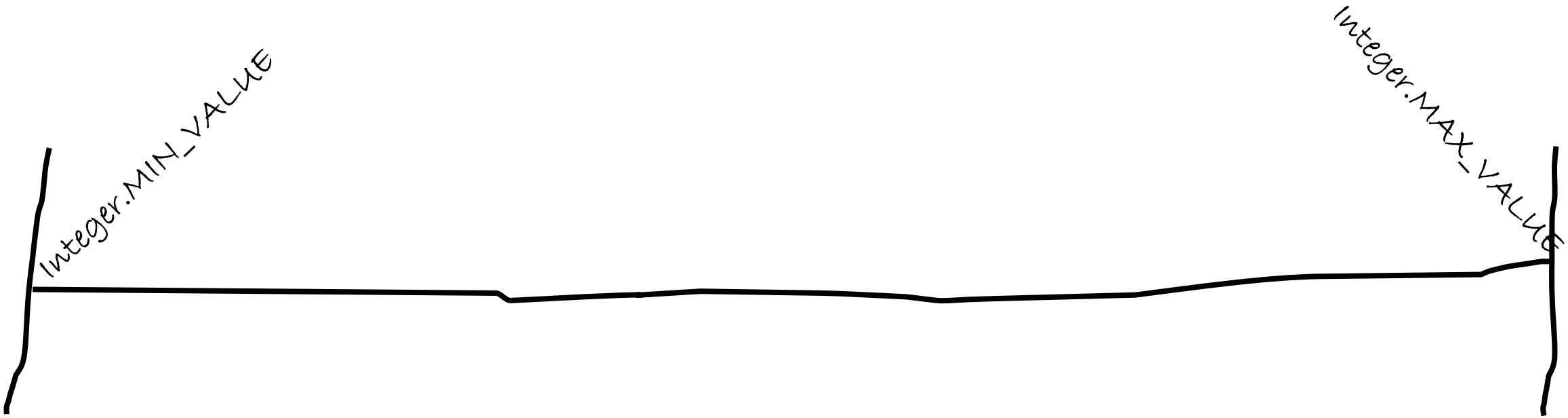
   0 - are not eligible for insurance

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

Lab 2 Review

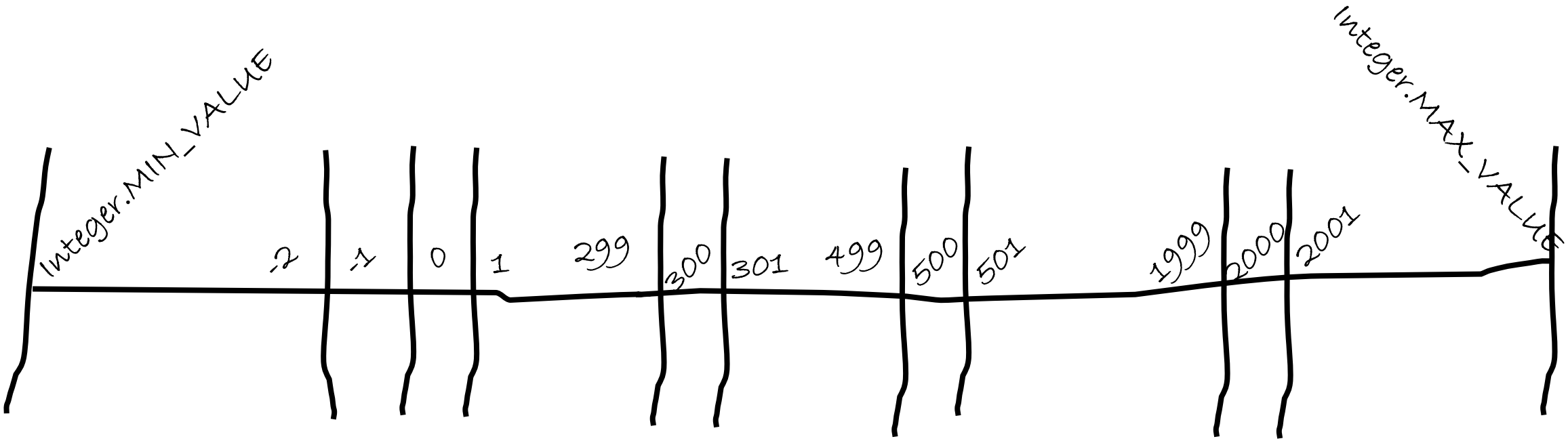
- int Insurance.premium(int age, Status ncb, boolean lowRisk)
- Treat the output (return value) like an enum
- Why? According to the specification it can only take on one of five discrete values:
  - You cannot write tests to generate any other value – there is no input according to the specification that will do so
  - So there is no need to consider all the other values not mentioned
  - If the code incorrectly generates invalid results, it will fail the associated test
  - There is no way, with EP testing, to deliberately generate invalid results
- Use five partitions, each with one value

Natural Ranges for return value from premium

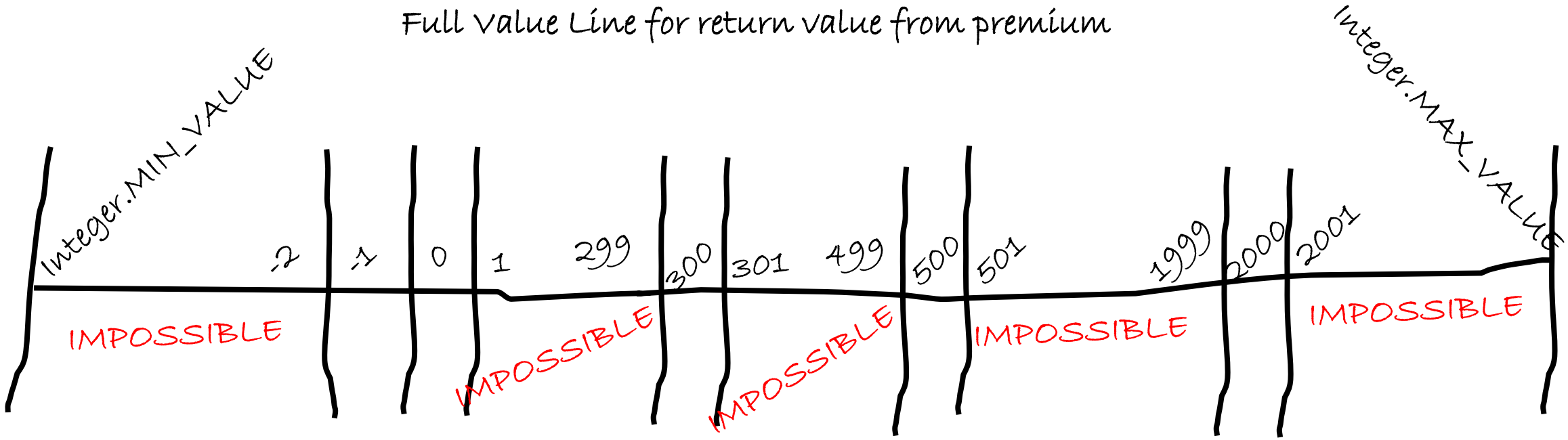


DISCUSS

Specification-Defined Ranges for return value from premium



DISCUSS

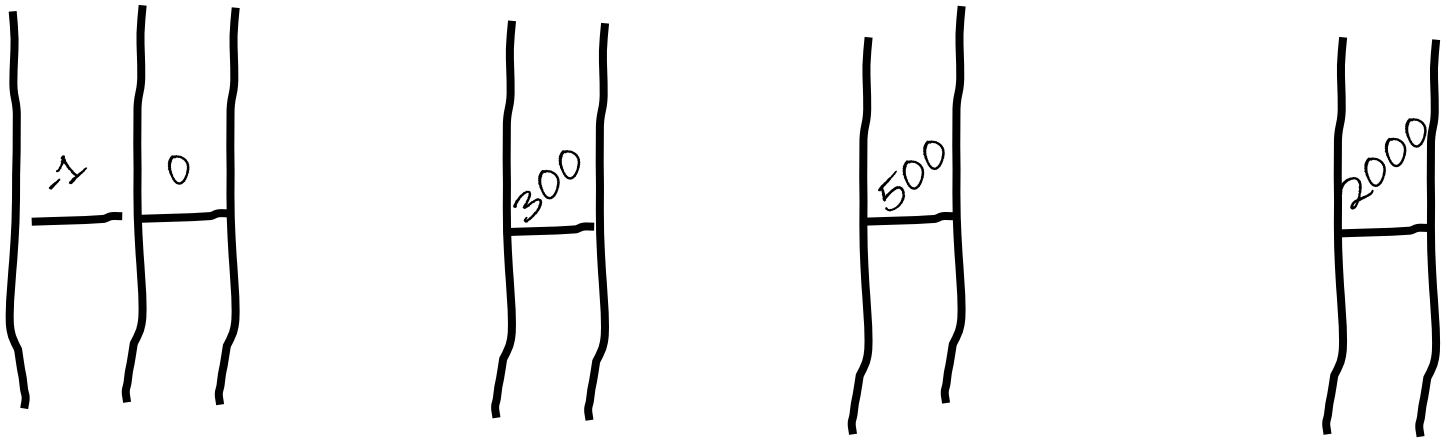


IMPOSSIBLE: THERE ARE NO INPUT VALUES FOR WHICH THIS IS THE SPECIFIED OUTPUT VALUE

SO YOU CANNOT CREATE A TEST FOR THIS RANGE – IT IS NOT A VALID TCI

NOTE: THIS ONLY APPLIES FOR OUTPUTS!!

Value Line for return value from premium



THIS PRODUCES FIVE INDIVIDUAL RANGES

HENCE: TREAT LIKE AN ENUM WITH 5 VALUES IN THIS ORDER

Tutorial: Lab 2 Review

- Develop EP tests for Insurance.premium

1. Analysis
2. Test Coverage Items
3. Test Cases
4. Review
5. Implement
6. Run
7. Results

1. Natural Ranges:

- **age**: [Integer.MIN_VALUE ✔ .. Integer.MAX_VALUE ✔]
- **ncb:** [YES ✔] [NO ✔] [NOT_STATED ✔]
- **lowRisk:** [true ✔] [false ✔]
- **Return Value:** [-1 ✔][0 ✔][300 ✔][500 ✔][2000 ✔]

Natural Ranges

Parameter	Natural Range
age	Integer.MIN_VALUE..Integer.MAX_VALUE ✔
ncb	YES ✔
	NO ✔
	NOT_STATED ✔
lowRisk	true ✔
	false ✔
Return Value	-1 ✔
	0 ✔
	300 ✔
	500 ✔
	2000 ✔

2. 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]

```
invalid age
younger than 16
less than 25/at least 25
less than 45
older than 65
```

3. Equivalence Partitions

Input EPs

Parameter	Error	Equivalence Partition
age	Y ✔	Integer.MIN_VALUE..-1 ✔
	N ✔	0..15 ✔
	N ✔	16..24 ✔
	N ✔	25..44 ✔
	N ✔	45..65 ✔
	N ✔	66..Integer.MAX_VALUE ✔
ncb	N ✔	YES ✔
	N ✔	NO ✔
	Y ✔	NOT_STATED ✔
lowRisk	N ✔	true ✔
	N ✔	false ✔

Output EPs

Parameter	Equivalence Partition
Return Value	-1 ✔
	0 ✔
	300 ✔
	500 ✔
	2000 ✔

Test Coverage Items

TCI	Error	Parameter	Equivalence Partition	Test Case (complete later)
EP1	Y	age	Integer.MIN_VALUE..-1	
EP2	N		0..15	
EP3	N		16..24	
EP4	N		25..44	
EP5	N		45..65	
EP6	Y		66..Integer.MAX_VALUE	
EP7	N	ncb	YES	
EP8	N		NO	
EP9	Y		NOT_STATED	
EP10	N	lowRisk	true	
EP11	N		false	
EP12		Return Value	-1	
EP13			0	
EP14			300	
EP15			500	
EP16			2000	

Equivalence Values

Parameter	Equivalence Partition	Equivalence Value
age	Integer.MIN_VALUE..-1	-5000
	0..15 ✔	8 ✔
	16..24 ✔	20 ✔
	25..44 ✔	35 ✔
	45..65 ✔	55 ✔
	66..Integer.MAX_VALUE ✔	5000 ✔
ncb	YES ✔	YES ✔
	NO ✔	NO ✔
	NOT_STATED ✔	NOT_STATED ✔
lowRisk	true ✔	true ✔
	false ✔	false ✔

LAB Instructions

- When creating the Test Cases strictly follow the parameter ordering, adding as many uncovered TCIs (in order) in each new Test Case, working through the parameters from first to last.
- If you have a choice between two different values (as both are already used) then use the one with the highest TCI ID (as shown in the book/lectures).
- Note: this means the highest non-duplicate TCI ID
- And not forgetting the output TCI's – before you do the error cases, double-check that you have created all the output TCI's, and if you haven't (hint) then add a test here for the uncovered TCI (working out what inputs are required to create it).

INITIAL/CANDIDATE TEST CASES

Test Cases					
		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value

INITIAL/CANDIDATE TEST CASES

Test Cases

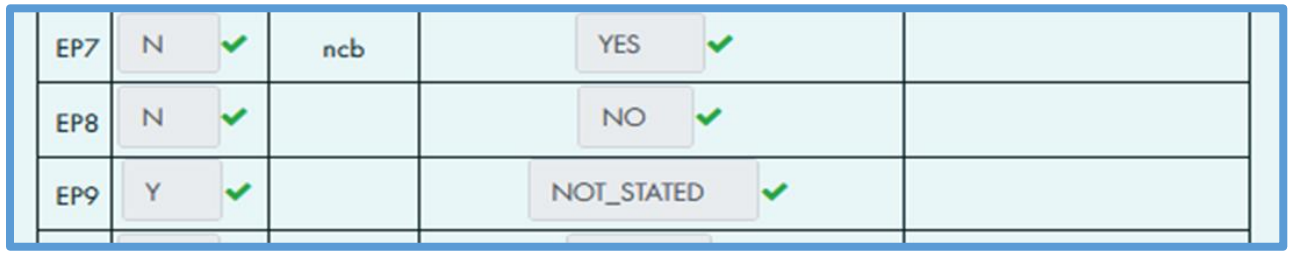
		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7			

TCI	Error	Parameter	Equivalence Partition	Test Case (complete later)
EP1	Y ✔	age	Integer.MIN_VALUE..-1 ✔	
EP2	N ✔		0..15 ✔	
EP3	N ✔		16..24 ✔	
EP4	N ✔		25..44 ✔	
EP5	N ✔		45..65 ✔	
EP6	Y ✔		66..Integer.MAX_VALUE ✔	

INITIAL/CANDIDATE TEST CASES

Test Cases

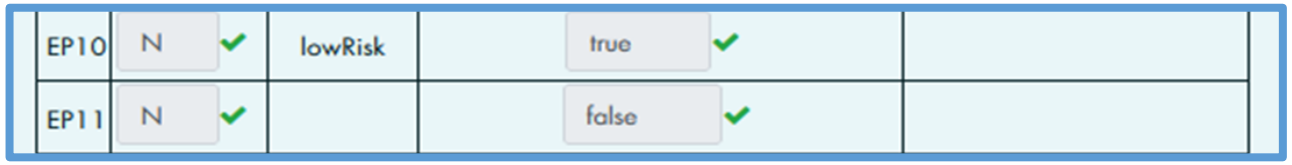
		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES		



INITIAL/CANDIDATE TEST CASES

Test Cases

		Inputs			Expected Results
ID	**TCI Covered**	**age**	**ncb**	**low-risk**	**return value**
T1.1	EP2, EP7, EP10, EP13	7	YES	true	



INITIAL/CANDIDATE TEST CASES

Test Cases

		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0

EP12		Return Value	-1 ✔	
EP13			0 ✔	
EP14			300 ✔	
EP15			500 ✔	
EP16			2000 ✔	

INITIAL/CANDIDATE TEST CASES

Test Cases

		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000

TCI	Error	Parameter	Equivalence Partition	Test Case (complete later)
EP1	Y	age	Integer.MIN_VALUE..-1	
EP2	N		0..15	
EP3	N		16..24	
EP4	N		25..44	
EP5	N		45..65	
EP6	Y		66..Integer.MAX_VALUE	

EP7	N	ncb	YES	
EP8	N		NO	
EP9	Y		NOT_STATED	

EP10	N	lowRisk	true	
EP11	N		false	

INITIAL/CANDIDATE TEST CASES

Test Cases

		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500

TCI	Error	Parameter	Equivalence Partition	Test Case (complete later)
EP1	Y	age	Integer.MIN_VALUE..-1	
EP2	N		0..15	
EP3	N		16..24	
EP4	N		25..44	
EP5	N		45..65	
EP6	Y		66..Integer.MAX_VALUE	

EP7	N	ncb	YES	
EP8	N		NO	
EP9	Y		NOT_STATED	

EP10	N	lowRisk	true	
EP11	N		false	

INITIAL/CANDIDATE TEST CASES

Test Cases

		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500

TCI	Error	Parameter	Equivalence Partition	Test Case (complete later)
EP1	Y	age	Integer.MIN_VALUE..-1	
EP2	N		0..15	
EP3	N		16..24	
EP4	N		25..44	
EP5	N		45..65	
EP6	Y		66..Integer.MAX_VALUE	

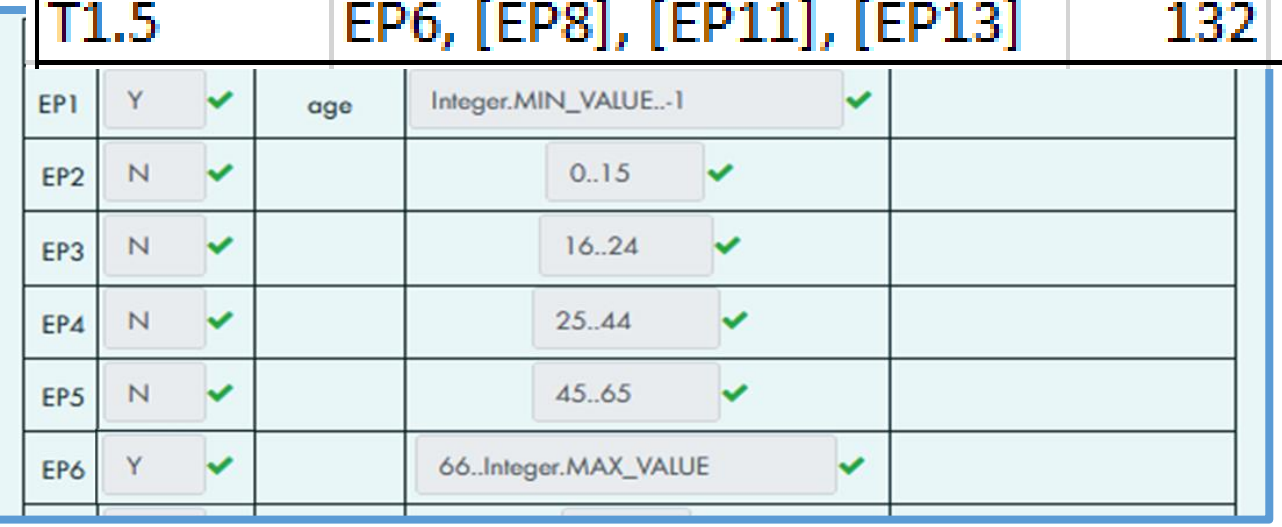
EP7	N	ncb	YES	
EP8	N		NO	
EP9	Y		NOT_STATED	

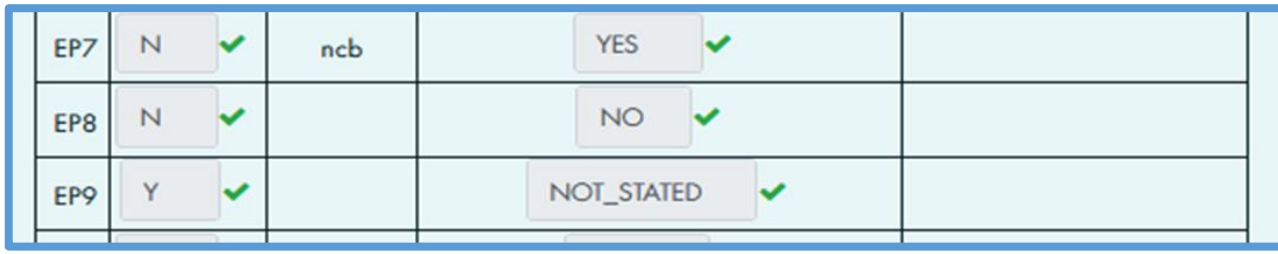
EP10	N	lowRisk	true	
EP11	N		false	

INITIAL/CANDIDATE TEST CASES

Test Cases

		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0





INITIAL/CANDIDATE TEST CASES

Test Cases

ID	TCI Covered			Expected Results Return value
T1.1	EP2, EP7, EP10, EP13			0
T1.2	EP3, EP8, EP11, EP16			2000
T1.3	EP4, [EP8], [EP11], EP15			500
T1.4	EP5, [EP8], [EP11], [EP15]			500
T1.5	EP6, [EP8], [EP11], [EP13]		NO	false 0

We have covered all the non-error INPUT TCI's

Have we covered all the OUTPUT TCI's?

EP1	Y	age	Integer.MIN_VALUE..-1
EP2	N		0..15
EP3	N		16..24
EP4	N		25..44
EP5	N		45..65
EP6	Y		66..Integer.MAX_VALUE

EP7	N	ncb	YES
EP8	N		NO
EP9	Y		NOT_STATED

EP10	N	lowRisk	true
EP11	N		false

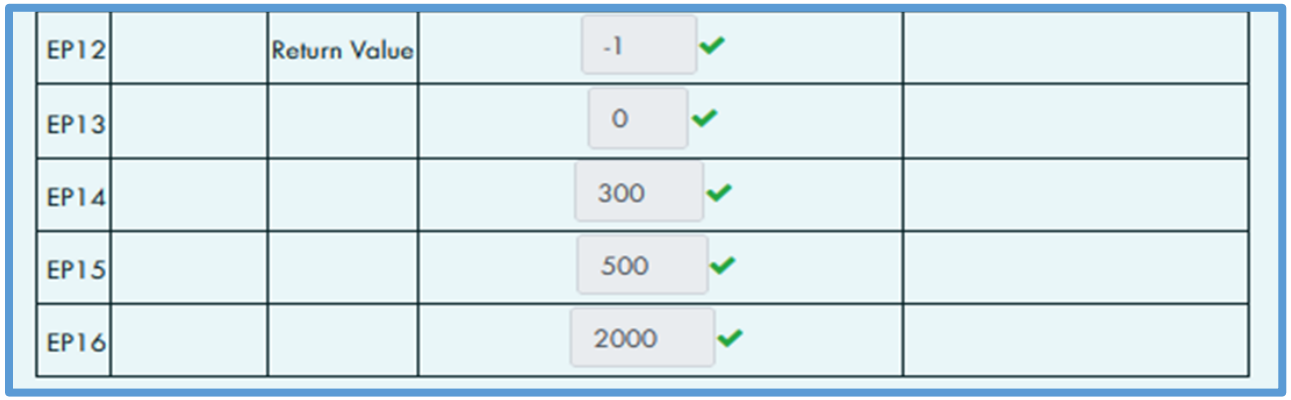
INITIAL/CANDIDATE TEST CASES

Test Cases

ID	TCI Covered			Expected Results Return value
T1.1	EP2, EP7, EP10, EP13			0
T1.2	EP3, EP8, EP11, EP16			2000
T1.3	EP4, [EP8], [EP11], EP15			500
T1.4	EP5, [EP8], [EP11], [EP15]			500
T1.5	EP6, [EP8], [EP11], [EP13]		NO	false 0

We have covered all the non-error INPUT TCI's

Have we covered all the OUTPUT TCI's?



INITIAL/CANDIDATE TEST CASES

Test Cases

ID	TCI Covered			Expected Results Return value
T1.1	EP2, EP7, EP10, EP13			0
T1.2	EP3, EP8, EP11, EP16			2000
T1.3	EP4, [EP8], [EP11], EP15			500
T1.4	EP5, [EP8], [EP11], [EP15]			500
T1.5	EP6, [EP8], [EP11], [EP13]		NO	false 0

Have we covered all the OUTPUT TCI's?

Create a TC for 300

EP12		Return Value	-1 ✔	
EP13			0 ✔	
EP14			300 ✔	
EP15			500 ✔	
EP16			2000 ✔	

INITIAL/CANDIDATE TEST CASES

Test Cases

		Inputs			Expected Results
ID	**TCI Covered**	**age**	**ncb**	**low-risk**	**return value**
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	EP14				300

INITIAL/CANDIDATE TEST CASES

Test Ca

			Inputs		Expected Results
ID			ncb	low-risk	return value
T1.1			YES	true	0
T1.2			NO	false	2000
T1.3			NO	false	500
T1.4		55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP7], [EP10], EP14		YES	true	300

For return value 300

ncb must be YES, EP7
low-risk must be true, EP10

INITIAL/CANDIDATE TEST CASES

Test Ca

			Inputs		Expected Results
ID			ncb	low-risk	return value
T1.1			YES	true	0
T1.2			NO	false	2000
T1.3			NO	false	500
T1.4		55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP7], [EP10], EP14		YES	true	300

For return value 300

ncb must be YES, EP7
low-risk must be true, EP10
must pick a value for age

NDIDATE TEST CASES

For return value 300

age: pick the highest TCI ID for age that works
EP5 has value 55

		Inputs			Expected Results
		age	ncb	low-risk	return value
		7	YES	true	0
		20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP7], [EP10], EP14	55	YES	true	300

NDIDATE TEST CASES

For return value 300

ncb must be YES, EP7
low-risk must be true, EP10
age is 55, EP5

		Inputs			Expected Results
		age	ncb	low-risk	return value
		7	YES	true	0
		20	NO	false	2000
		35	NO	false	500
		55	NO	false	500
	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300

DIDATE TEST CASES

T1.6 inputs are all duplicates

ncb must be YES, [EP7]
low-risk must be true, [EP10]
age is 55 [EP5]

		Inputs			Expected Results
			ncb	low-risk	return value
		7	YES	true	0
		20	NO	false	2000
		35	NO	false	500
		55	NO	false	500
	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300

INITIAL /CANDIDATE ...ASES

Can't generate -1 with non-error INPUT TCI's

So, next handle the error input TCI's

Test Cases

ID	TCI Covered	...	...	...sk	Expected Results return value
T1.1	EP2, EP7, EP1(			true	0
T1.2	EP3, EP8, EP11			false	2000
T1.3	EP4, [EP8], [EP			false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300

INITIAL/CANDIDATE TEST CASES

So, next handle the error input TCI's

EP1

Test Cases

ID	TCI Covered			sk	Expected Results return value
T1.1	EP2, EP7, EP10			true	0
T1.2	EP3, EP8, EP11			false	2000
T1.3	EP4, [EP8], [EP			false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*	-5000			.

TCI	Error	Parameter	Equivalence Partition	Test Case (complete later)
EP1	Y ✔	age	Integer.MIN_VALUE..-1 ✔	

Pick most largest TCI IDs that "work" for ncb and low-risk

And work out return value

DIDATE TEST CASES

		Inputs			Expected Results
		age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1

INIT ASES

Pick most largest TCI IDs that "work" for ncb and low-risk

Note: the error test cases does not cover the non-error TCI's (due to error hiding)

Test Cases

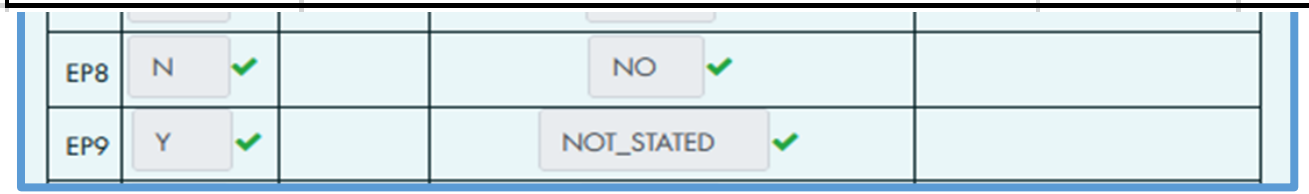
ID	TCI Covered			sk	Expected Results return value
T1.1	EP2, EP7, EP10			true	0
T1.2	EP3, EP8, EP11			false	2000
T1.3	EP4, [EP8], [EP			false	500
T1.4	EP5, [EP8], [EP	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1

INIT ASES

Now generate a TC to cover the final uncovered error TCI EP9

Test Cases

ID	TCI Covered			sk	Expected Results return value
T1.1	EP2, EP7, EP10			true	0
T1.2	EP3, EP8, EP11			false	2000
T1.3	EP4, [EP8], [EP			false	500
T1.4	EP5, [EP8], [EP	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1
T1.8*	EP9*,[12]	5000	NOT_STATED	false	-1



INITIAL/CANDIDATE TEST CASES

Test Cases

		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1
T1.8*	EP9*,[12]	5000	NOT_STATED	FALSE	-1

LAB INSTRUCTIONS: REVIEW

- Are all the TCI's covered?
- Are there any duplicate TC's?

- I expect you to find a duplicate test case during your review
- Fix this (by deleting the test case)
- But DO NOT reorder the tests (though fixup the test case IDs so there is no gap in the numbering

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	
EP2	
EP3	
EP4	
EP5	
EP6	
EP7	
EP8	
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	
EP3	
EP4	
EP5	
EP6	
EP7	
EP8	
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	
EP4	
EP5	
EP6	
EP7	
EP8	
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	
EP5	
EP6	
EP7	
EP8	
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	
EP6	
EP7	
EP8	
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	
EP7	
EP8	
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	
EP8	
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	T1.1
EP8	
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	T1.1
EP8	T1.2
EP9	
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	T1.1
EP8	T1.2
EP9	T1.8
EP10	
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	T1.1
EP8	T1.2
EP9	T1.8
EP10	T1.1
EP11	
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	T1.1
EP8	T1.2
EP9	T1.8
EP10	T1.1
EP11	T1.2
EP12	
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	T1.1
EP8	T1.2
EP9	T1.8
EP10	T1.1
EP11	T1.2
EP12	T1.7
EP13	
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	T1.1
EP8	T1.2
EP9	T1.8
EP10	T1.1
EP11	T1.2
EP12	T1.7
EP13	T1.1
EP14	

Review: All TCIs covered?

Test Cases	
ID	**TCI Covered**
T1.1	EP2, EP7, EP10, EP13
T1.2	EP3, EP8, EP11, EP16
T1.3	EP4, [EP8], [EP11], EP15
T1.4	EP5, [EP8], [EP11], [EP15]
T1.5	EP6, [EP8], [EP11], [EP13]
T1.6	[EP5], [EP7], [EP10], EP14
T1.7*	EP1*, EP12
T1.8*	EP9*,[12]

TCI	TC
EP1	T1.7
EP2	T1.1
EP3	t1.2
EP4	T1.3
EP5	T1.4
EP6	T1.5
EP7	T1.1
EP8	T1.2
EP9	T1.8
EP10	T1.1
EP11	T1.2
EP12	T1.7
EP13	T1.1
EP14	T1.6

DUPLICATES?

Test Cases

		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
T1.4	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1
T1.8*	EP9*,[12]	5000	NOT_STATED	FALSE	-1

ONLY ONE TEST CASE TO CONSIDER

Test Cases

		Inputs			Expected Results
ID	TCI Covered	age	ncb	low-risk	return value
T1.1	EP2, EP7, EP10, EP13	7	YES	true	0
T1.2	EP3, EP8, EP11, EP16	20	NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
T1.4	EP5, EP8], [EP11], [EP15]	55	NO	false	500
T1.5	EP6, [EP8], [EP11], [EP13]	132	NO	false	0
T1.6	[EP5] [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1
T1.8*	EP9*,[12]	5000	NOT_STATED	FALSE	-1

CONSIDER T1.4

Test Cases

ID	TCI Covered	age	ncb		
T1.1	EP2, EP7, EP10, EP13	7			
T1.2	EP3, EP8, EP11, EP16	20			
T1.3	EP4, [EP8], [EP11], EP15	35			
T1.4	EP5, EP8], [EP11], [EP15]	55			
T1.5	EP6, [EP8], [EP11], [EP13]	132		false	0
T1.6	[EP5] [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1
T1.8*	EP9*,[12]	5000	NOT_STATED	FALSE	-1

T1.4 and T1.6 cover EP5

CONSIDER T1.4

Test Cases

ID	TCI Covered	age	ncb		
T1.1	EP2, EP7, EP10, EP13	7			
T1.2	EP3, EP8, EP11, EP16	20			
T1.3	EP4, [EP8], [EP11], EP15	35			
T1.4	EP5, EP8], [EP11], [EP15]	55			
T1.5	EP6, [EP8], [EP11], [EP13]	132		false	0
T1.6	[EP5] [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1
T1.8*	EP9*,[12]	5000	NOT_STATED	FALSE	-1

T1.4 and T1.6 cover EP5
T1.6 is needed

CONSIDER T1.4

Test Cases

ID	TCI Covered	age	ncb		
T1.1	EP2, EP7, EP10, EP13	7			
T1.2	EP3, EP8, EP11, EP16	20			
T1.3	EP4, [EP8], [EP11], EP15	35			
T1.4	EP5, [EP8], [EP11], [EP15]	55			
T1.5	EP6, [EP8], [EP11], [EP13]	132		false	0
T1.6	[EP5], [EP7], [EP10], EP14	55	YES	true	300
T1.7*	EP1*, EP12	-5000	NO	false	-1
T1.8*	EP9*,[12]	5000	NOT_STATED	FALSE	-1

T1.4 and T1.6 cover EP5
T1.6 is needed
EP5 covered by T1.5
EP8 covered by T1.2
EP11 covered by T1.2
EP15 covered by T1.3

Delete T1.4
And fixup the numbering

ID	TCI Covered			sk	Expected Results return value
T1.1	EP2, EP7, EP1(			true	0
T1.2	EP3, EP8, EP11		NO	false	2000
T1.3	EP4, [EP8], [EP11], EP15	35	NO	false	500
	EP5, [EP8], [EP11], [EP15]	55	NO	false	500
T1.4	EP6, [EP8], [EP11], [EP13]	5000	NO	false	0
T1.5	EP5, [EP7], [EP10], EP14	55	YES	TRUE	300
T1.6*	EP1*, 12	-5000	NO	false	-1
T1.7*	EP9*,[12]	5000	NOT_STATED	FALSE	-1

Test Cases

ID	TCI Covered	Input: age	Input: ncb	Input: lowRisk	Exp. Results: return value
T1.1	EP2,7,10,13	7	YES	true	0
T1.2	EP3,8,11,16 ✔	20 ✔	NO ✔	false ✔	2000 ✔
T1.3	EP4,[8],[11],15 ✔	35 ✔	NO ✔	false ✔	500 ✔
T1.4	EP6,[8],[11],[13] ✔	5000 ✔	NO ✔	false ✔	0 ✔
T1.5	EP5,[7],[10],14 ✔	55 ✔	YES ✔	true ✔	300 ✔
T1.6	EP1*,12 ✔	-5000 ✔	NO ✔	false ✔	-1 ✔
T1.7	EP9*,[12] ✔	5000 ✔	NOT_STATED ✔	false ✔	-1 ✔

COMPLETE TCI TABLE

TCI	Error	Parameter	Equivalence Partition	Test Case
EP1	Y	age	Integer.MIN_VALUE..-1	T1.6
EP2	N		0..15	T1.1
EP3	N		16..24	T1.2
EP4	N		25..44	T1.3
EP5	N		45..65	T1.5
EP6	N		66..Integer.MAX_VALUE	T1.4
EP7	N	ncb	YES	T1.1
EP8	N		NO	T1.2
EP9	Y		NOT_STATED	T1.7
EP10	N	lowRisk	true	T1.1
EP11	N		false	T1.2
EP12	N	return value	-1	T1.6
EP13	N		0	T1.1
EP14	N		300	T1.5
EP15	N		500	T1.3
EP16	N		2000	T1.2

2. Review your work

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

Note: if you do not get full marks for the previous questions, I will manually mark these two review questions.

Fault1

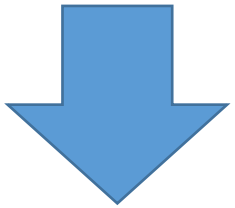
- Do your tests find fault1?

```
else {
    p=500;
    if (age<25)
        p += 1500;
    // else if ((age<45 || lowRisk) && ncb==Status.YES)
    //     p -= 200; fault 1 - remove entire partition
}
```

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;
```