



### 3. Design test cases using Boundary Value Analysis

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Sign here to indicate that you have read all relevant material provided /available on Moodle while performing and writing this experiment

**Late Submission Details (if any)**

Reason(s) of late submission	Date of practical performance	Date of practical submission

**References used**

1	Name and author of reference book(s) with page nos.
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**Rubrics for assessment of Experiment:**

Indicator	Poor	Average	Good
Timeliness Maintains Experiment deadline (3)	Experiment not done (0)	One or More than One week late (1-2)	Maintains deadline (3)
Completeness and neatness Complete all parts of Experiment (3)	N/A	< 80% complete (1-2)	100% complete (3)
Originality Extent of plagiarism (2)	Copied it from someone else (0)	At least try to implement but could not succeed (1)	Implemented (2)
Knowledge In depth knowledge of the Experiment (2)	Unable to answer any questions (0)	Unable to answer few questions (1)	Able to answer all questions (2)

**Assessment Marks:**

Timeliness	
Completeness and neatness	
Originality	
Knowledge	
Total (Out of 10)	

**Signature of Teacher with date:**

**FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING**  
**Department of Electronics and Computer Science**

**1. Course, Subject & Experiment Details**

Course & Branch	T.E. (ECS)	Estimated Time	02 Hours Per Week
Current Semester	Semester V	Subject Name	STQA
Chapter No. & Unit	2. 1	Chapter Title	Testing Techniques
Experiment Type	Design of test cases	Subject Code	ECL503

**2. Aim & Objective of Experiment**

1. To design test cases for a system using Boundary Value Analysis (ECCDO501.2)

**3. Expected Outcome of Experiment**

1. Test cases using Boundary Value Checking and Robustness Testing methods.

**4. Brief Theoretical Description**

Boundary Value Analysis suggests that test cases designed with boundary values have high chance of finding errors. It means that most of the failures are due to boundary values. It is applicable when module to be tested is a function of many independent variables. This method is important for physical quantities where boundary condition checking is crucial e.g. systems with requirements of min and max temperature, pressure, speed etc.

**5. Design test cases for the system under consideration using Testing techniques.**

1. A program calculates the GCD of three numbers in the range [1, 50]. Design test cases for this program using BVC, robust testing, and worst-case testing methods.
2. A program reads the data of employees in a company by taking the following inputs and prints them:  
Name of Employee (Max. 15 valid characters A–Z, a–z, space)  
Employee ID (10 characters)  
Designation (up to 20 characters)  
Design test cases for this program using BVC, robust testing, and worst-case testing methods.
3. A program reads players' records with the following detail and prints a team-wise  
A list containing player names with their batting average:  
Player name (max. 30 characters)  
Team name (max. 20 characters)  
Batting average.  
Design test cases for this program using BVC, robust testing, and worst-case testing methods

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Q.1

There are three variables. Total no. of test cases  $4n+1=13$ .

Min value	1
Min+ value	2
Max- value	49
Max value	50
Nominal value	24

Test case	No.1	No.2	No.3	Expected value
1	8	40	50	2
2	8	40	49	4
3	8	40	45	1
4	8	40	46	2
5	45	40	25	5
6	45	48	25	1
7	7	48	25	1
8	7	47	25	1
9	26	25	7	1
10	7	18	15	1
11	18	32	14	2
12	29	32	14	1
13.	17	14	29	1

Robust testing :- The total number test case will be  
 $6 \times 3 + 1 = 19$

$\text{Min} = 0, \text{Min} = 1, \text{Max} = 49, \text{Max} = 50, \text{Max} = 51$  nominal = 25

	No.1	No.2	No.3	Expected output.
2	8	40	50	2
3	8	40	44	4
4	8	40	45	1
5	25	40	45	2
6	25	48	45	5
7	25	48	45	1
8	25	47	7	1
9	25	16	7	1
10	25	18	7	1
11	14	18	7	1
12	14	18	32	2
13	14	29	32	1
14	17	14	29	1
15	14	43	8	1
16	14	14	7	1
17	12	45	14	1
18	17	12	45	1
19	12	15	21	3.

Worst case testing :- The total no. test cases will be  $3^n = 5^3 = 125$

Min :- 1, Min+ :- 2, Max = 50, Max-1 :- 49 Nominal value 26

Test cases :-

ID	No.1 No.2 No.3			Expected output	ID	No.1 No.2 No.3			O/P	
	ID	No.1	No.2	No.3	O/P	ID	No.1	No.2	No.3	
1	8	40	50	2		20	8	40	50	2
2	8	40	44	4		21	8	40	44	4
3	8	40	45	1		22	8	40	45	1
4	8	40	46	2		23	25	40	45	2
5	25	40	45	5		24	25	48	45	2
6	25	40	45	1		25	25	48	45	5
7	20	48	45	1		26	25	47	7	1
8	25	48	4	1		27	28	16	7	1
9	25	47	7	1		28	25	18	7	1
10	25	16	7	1		29	14	18	7	1
11	25	18	7	1		30	14	18	32	1
12	<del>25</del> 14	18	7	1		31	14	29	32	2
13	14	29	32	2		32	17	14	29	1
14	17	14	29	1		33	14	43	8	1
15	14	43	8	1		34	14	14	7	1
16	14	14	7	1		35	<del>14</del> 14	45	14	1
17	12	45	14	1		36	12	12	45	1
18	17	12	45	3		37	17	12	21	81
19	12	15	21	1		38	12	15	21	83

Id	No.1	No.2	No.3	O/P.	$\Sigma$	No.1	No.2	No.3	O/P.
40	8	40	50	2	68	17	17	21	1
41	8	40	44	4	66	22	22	17	1
42	8	40	45	1	67	23	26	27	1
43	8	40	46	2	68	25	28	29	1
44	25	40	45	5	69	25	35	45	5
45	25	40	45	1	70	27	27	29	1
46	20	48	45	1	71	18	16	17	1
47	25	48	4	1	72	15	18	20	1
48	25	47	7	1	73	10	18	20	2
49	25	16	7	1	74	10	10	22	2
50	25	18	7	1	75	21	17	21	1
51	14	18	7	1	76	22	10	22	2
52	14	20	32	2	77	24	22	26	2
53	17	14	29	1	78	25	35	30	5
54	14	43	8	1	79	21	35	7	7
55	14	14	7	1	80	21	35	14	7
56	12	45	14	1	81	18	9	21	3
57	17	12	45	3	82	18	9	20	1
58	12	15	21	1	83	11	12	13	1
59	12	15	21	3	84	12	13	14	1
60	17	12	21	1	85	14	19	20	1
61	12	12	45	1	86	19	14	25	1
62	14	45	14	1	87	22	19	27	1
63	14	14	7	1	88	8	40	50	2
64.	14	43	8	1	89.	17	14	29	1

Fd	No.1	No.2	No.3	O/P.	Id	No.1	No.2	No.3	O/P
90	2	2	2	2	15	4	5	6	1
91	4	2	2	2	16	7	8	9	1
92	8	7	16	8	17	11	22	33	11
93	22	24	25	1	18	12	24	36	6
94	23	24	25	1	19	14	7	35	7
95	27	9	18	9	20	18	37	35	1
96	27	9	19	1	21	19	18	17	1
97	23	24	27	1	22	19	38	19	19
98	26	27	28	1	23	24	32	40	8
99	29	35	37	1	24	40	30	35	5
100	30	32	36	2	25	30	32	36	2
01	32	36	16	8					
2	35	36	38	1					
3	36	35	39	1					
4	40	41	42	1					
5	45	46	47	1					
6	48	49	50	1					
7	1	2	50	1					
8	1	25	50	1					
9	1	25	5	1					
10	25	25	50	5					
11	10	20	30	10					
12	11	12	13	1					
13	12	13	14	1					
14	17	15	14	1					

Q.2)

BVC Testing : The total no. of test case will be

$$4(m+1) = 4 \times 2 + 1 = 73.$$

For A :  $\min = 1$ ,  $\min^+ = 2$ ,  $\max^+ = 15$ ,  $\max^- = 14$ , Nominal = 9.

For B :  $\min = 10$ ,  $\max = 10$ ,  $\max^- = 9$ ,  $\min^+ = 11$ , Nominal = 10.

For C :  $\min = 1$ ,  $\min^+ = 2$ ,  $\max = 20$ ,  $\max^- = 19$ , Nominal = 10.

Test case ID	A	B	C	Expected Input
1	8	9	10	Valid
2	2	10	20	Valid
3	1	10	19	Valid
4	15	10	10	Valid
5	9	11	2	Invalid
6	8	9	1	Valid
7	7	11	22	Invalid
8	5	10	21	Invalid
9	5	9	20	Valid
10	6	10	19	Valid
11	7	11	10	Valid
12	8	11	10	Valid
13	9	11	10	Valid.

Robust testing:- The total no of test cases will be  $G(n)+1$   
 $G(3)+1 = 19$ .

Test case	A	B	C	Expected O/P.
1	8	9	17	V
2	8	10	12	V
3	8	11	11	V
4	8	11	22	IV
5	8	10	25	I/IV
6	6	9	17	V
7	8	10	15	V
8	8	11	9	V
9	6	9	3	V
10	7	10	12	V
11	5	11	14	V
12	4	11	16	V
13	3	9	19	V
14	2	10	29	I/IV
15	6	9	43	I/IV
16	5	10	20	V
17	2	9	18	V
18	1	11	17	V
19	3	10	14	V

Worst case test:- The total no. of test case will be  $3^n = 5^3 = 125$

These case Id A B C

ID	A	B	C	O/P.	ID	A	B	C	O/P.
1	7	9	21	V	22	8	9	21	Invalid
2	7	10	19	V	23	8	9	1	V.
3	6	9	15	V	24	9	9	20	V
4	5	9	14	V	25	5	9	26	IV
5	4	9	18	V	26	7	9	17	V
6	14	9	17	V	27	8	9	17	V
7	3	9	16	V	28	9	9	17	V
8	12	9	15	V	29	10	9	15	V
9	15	9	14	IV	30	8	11	10	V
10	8	10	12	V	31	8	10	12	V
11	7	11	11	V	32	7	10	11	V
12	6	11	10	V	33	6	11	10	V
13	5	11	9	V	34	6	11	9	V
14	3	11	8	V	35	6	11	8	V
15	7	11	7	V	36	6	15	7	IV
16	8	10	6	V	37	6	9	11	V
17	10	10	5	V	38	4	9	13	V
18	11	11	4	V	39	5	9	14	V
19	12	10	3	V	40	5	9	15	V
20	13	11	2	V	41	5	10	16	V
21	14	9	17	V	42	5	10	17	V

Id	A	B	C	E. O/P.
43	1	9	1	V
44	2	10	2	V
45	3	11	3	V
46	4	10	4	V
47	5	11	5	V
48	6	9	6	V
49	7	11	7	V
50	8	10	8	V
51	9	9	9	V
52	10	10	10	V
53	11	11	11	V
54	12	9	12	V
55	13	9	13	V
56	14	8	14	IV
57	15	7	42	IV
58	14	6	69	IV
59	13	5	31	IV
60	12	4	41	IV
61	11	3	51	IV
62	10	2	61	IV
63	9	1	21	IV
64	8	22	19	IV
65	7	43	21	IV
66	6	47	9	IV
67	5	48.	1	IV.

ID	A	B	C	O/P.		ID	A	B	C	O/P.	
75	75	5	9	1	V		100	14	10	14	V
76	76	4	10	2	V		101	13	11	16	V
77	77	3	10	3	V		102	3	9	17	V
78	78	2	10	5	V		103	11	10	18	V
79	76	1	10	17	V		104	1	9	9	V
80	78	3	11	18	V		105	12	10	11	V
81	77	5	11	15	V		106	2	11	12	V
82		7	11	14	V		107	14	9	8	V
83		9	9	9	V		108	4	10	7	V
84		11	11	10	V		109	13	9	6	V
85		13	9	12	V		110	3	11	5	V
86		15	10	14	V		111	7	9	4	V
87		2	11	15	V		112	17	13	3	V
88		4	10	12	V		113	19	14	13	IV
89		6	48	21	IV		114	21	22	14	IV
90		8	49	33	IV		115	24	32	15	IV
91		10	50	22	IV		116	27	37	18	IV
92		12	51	24	IV		117	28	39	19	IV
93		14	65	17	IV		118	27	45	20	IV
94		7	67	14	IV		119	29	44	18	IV
95		3	69	13	IV		120	31	42	14	IV
96		1	71	12	IV		121	34	41	12	IV
97		3	72	1	IV		122	2	12	20	IV
98		7	75	2	IV		123	2	13	21	IV
99		9	77	3	IV		124	3	9	12	V
						125	4	9	13	V	

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3) BVC testing There are 3 variables total no: of test cases  $4n+1 = 13$ .

Player name (A) Min=1 Min<sup>+</sup>=2, Max=30, Max<sup>-</sup>=29 Nominal  
~~Tham name~~ = 15

Tham name (B) :- Min= 1, Min<sup>+</sup>=2, Max=20, Max<sup>-</sup>=19  
 Nominal = 10

Batting average = Min = 0, Min<sup>+</sup> = 1, Max = 1, Max<sup>-</sup> = 0.9 Nominal = 0.5

Test cases.

Test ID	A	B	C	Expected value.
1	29	19	0	v
2	15	20	0.2	v
3	14	21	0.9	IV
4	32	6	1	IV
5	7	9	0.1	v
6	6	13	0.3	v
7	5	18	0.4	v
8	19	9	0.8	v
9	29	12	0.9	v
10	30	3	3	IV
11	2	8	0.6	v
12	1	5	0.5	v
13	40	4	0.7	IV

Robust testing No. of test cases  $6(n+1) = 19$ .

Player Name(A): Min = 1, Max = 10, ~~Min<sup>-</sup>~~ = 2, Nominal = 15.

Team Name(B): Min = 1, ~~Min<sup>-</sup>~~ = 0, Min<sup>+</sup> = 2, Nominal = 10  
Max = 20, Max<sup>-</sup> = 19, Max<sup>+</sup> = 21

Button Avg (C) :- Min = 0.2, Min<sup>-</sup> = 0.1, Min<sup>+</sup> = 0.1, Nominal = 0.5  
Max = 1, Max<sup>-</sup> = 0.9, Max<sup>+</sup> = 1.1

Test cases.

Test cases. ID.	A	B	C	Expected outcome
1	15	12	0.1	15, 12, 0.1
2	15	12	0.2	15, 12, 0.2
3	15	12	0.3	15, 12, 0.3
4	15	12	0.4	15, 12, 0.4
5	15	12	0.5	15, 12, 0.5
6	15	12	0.6	15, 12, 0.6
7	15	5	0.7	15, 0.7, 0.7
8	15	5	0.8	<del>15, 5, 0.8</del> , 15, 5, 0.8
9	30	6	0.1	30, 6, 0.1
10	30	7	0.3	30, 7, 0.3
11	30	4	0.1	30, 4, 0.1
12	30	14	0.3	30, 14, 0.3
13	36	15	0.5	Invalid.
14	18	19	0.8	18, 19, 0.8
15	17	19	0.7	17, 19, 0.7
16	15	18	0.5	15, 18, 0.5

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Test ID	A	B	C	Expected output.
17	14	18	0.4	14, 18, 0.4
18	20	11	9.3	<del>14, 18, 0.</del> Invalid.
19	21	12	-0.1	21, 12, -0.1

worst case testin ~~test~~

No. of test cases  $S^n = S^3 = 12S$

Player Name (A) Min = 1, Mint = 2, Max = 29, Max = 30, Nominal = 15

Team name (B) Min = 1, Mint = 2, Max = 19, Max = 20, Nominal = 10

Batting Avg Min = 0, Max = 2, Mint = 0.1, Max = 0.9, Nominal = 0.5

Test ID	A	B	C	Output
1	10	S	0	10, S, 0
2	10	S	0.1	10, S, 0.1
3	10	S	0.2	10, S, 0.2
4	10	S	0.3	10, S, 0.3
5	10	S	0.4	10, S, 0.4
6	10	S	0.5	10, S, 0.5
7	10	S	0.6	10, S, 0.6
8	10	S	0.7	10, S, 0.7
9	10	S	0.8	10, S, 0.8
10	10	S	0.9	10, S, 0.9
11	10	S	1	10, S, 1
12	18	18	0.3	18, 18, 0.3
13	18	18	0.2	18, 18, 0.2
14	18	18	0.1	18, 18, 0.1
15	18	18	0.5	18, 18, 0.5
16	19	9	0	19, 9, 0
17	19	9	0.1	19, 9, 0.1
18	19	9	0.2	19, 9, 0.2

Test ID	A	B	C	Output
2019	19	9	0.6	19, 9, 0.6
2120	19	9	0.1	19, 9, 0.1
21	19	9	0.2	19, 9, 0.2
22	19	9	0.3	19, 9, 0.3
23	19	9	0.4	19, 9, 0.4
24	19	9	0.5	19, 9, 0.5
25	19	9	0.6	19, 9, 0.6
26	19	9	0.7	19, 9, 0.7
27	25	12	0.8	19, 12, 0.8
28	25	12	0.9	25, 12, 0.9
29	25	12	1	25, 12, 1
30	25	12	0.7	25, 12, 0.7
31	25	12	0.4	25, 12, 0.4
32	25	12	0.3	25, 12, 0.3
33	18	12	0.1	18, 12, 0.1
34	21	12	0.2	18, 12, 0.2
35	37	12	0.8	Invalid.
36	50	12	0.9	Invalid.
37	12	12	1	12, 12, 1
3840	12	18	1.2	12, 18, 1.2
3946	12	18	0.1	12, 18, 0.1
40	12	18	0.6	12, 18, 0.6
41	28	18	0.3	28, 18, 0.3
42	28	18	0.4	28, 18, 0.4
43	28	12	0.3	28, 12, 0.3
44	28	12	0.4	28, 12, 0.4

Test ID	A	B	C	Output.
45	28	18	0.1	28, 18 0.1
46	28	18	0.2	28, 18 0.2
47	28	18	0.3	28, 18 0.3
48	28	18	0.4	28, 18 0.4
49	28	18	0.5	28, 18 0.5
50	25	18	0.6	25, 18 0.6
S1	28	18	0.7	28, 18 0.7
S2	25	18	0.8	25, 18 0.8
S3	25	18	0.8	25, 18, 0.8
S4	25	18	0.9	25, 18, 0.9.
S5	25	18	1	Invalid
S6	25	18	2	Invalid
S7	26	19	3	Invalid
S8	26	90	5	Invalid
S9	26	90	6	Invalid
S0	26	70	6	Invalid
S1	26	19	0.1	26, 19, 0.1
S2	37	19	0.2	<del>37, 19, 0.2</del> , Invalid.
S3	40	19	0.2	Invalid
S4	40	18	0.3	Invalid
S5	88	18	0.3	Invalid
S6	26	18	6	Invalid
S7	24	19	7	Invalid
S8	24	17	8	Invalid
S9	24.	17.	9.	Invalid.

Test ID.	A	B	C	Output.
70	17	7	0.7	17, 7, 0.7
71	17	7	0.8	17, 7, 0.8
72	17	7	0.9	17, 7, 0.9
73	17	7	1	17, 7, 1
74	18	8	0.6	18, 8, 0.6
75	18	8	0.5	18, 8, 0.5
76	18	8	0.4	18, 8, 0.4
77	18	8	0.3	18, 8, 0.3
78	18	8	0.2	18, 8, 0.2
79	19	9	0.1	19, 9, 0.1
80	19	9	0	19, 9, 0
81	19	9	0.1	19, 9, 0.1
82	19	9	0.2	19, 9, 0.2
83	20	2	0.3	20, 2, 0.3
84	20	2	0.4	20, 2, 0.4
85	20	2	0.5	20, 2, 0.5
86	21	21	0.6	Invalid
87	21	1	0.7	<del>21, 1, 0.7</del>
88	21	1	0.8	21, 1, 0.8
89	21	1	0.9	21, 1, 0.9
90	21	1	0.6	21, 1, 0.6
91	2S	1	0.5	21, 1, 0.5
92	2S	1	0.4	21, 1, 0.4
93	2S	1	0.3	2S, 1, 0.3
94	2S	1	0.2	2S, 1, 0.2
95	2S	6.	0.1	2S, 6, 0.1

Test ID.	A	B	C	Expected output
96	25	21	0.1	Invalid
97	25	21	0.2	Invalid
98	25	21	0.3	Invalid
99	25	21	0.4	Invalid
100	26	20	0.5	26, 20, 0.5
101	26	20	0.6	26, 20, 0.6
102	26	20	0.7	26, 20, 0.7
103	26	20	0.8	26, 20, 0.8
104	27	19	0.9	27, 19, 0.9
105	27	19	1	27, 19, 1
106	27	19	0.9	27, 19, 0.9
107	27	19	0.8	27, 19, 0.8
108	28	18	0.7	28, 18, 0.7
109	28	18	0.6	28, 18, 0.6
110	28	18	0.8	28, 18, <del>0.8</del> 0.8
111	28	18	0.4	28, 18, 0.4
112	29	17	0.5	29, 17, 0.5
113	29	17	0.4	29, 17, 0.4
114	29	16	0.3	29, 16, 0.3
115	29	16	0.2	29, 16, 0.2
116	30	17	0.1	30, 17, 0.1
117	30	17	1	30, 17, 1
118	30	16	0.1	30, 16, 0.1
119	30	16	0.2	30, 16, 0.2
120.	31	15	0.3	31, 15, 0.3

19

ID	A	B	C	Output.
121	20	19	0.9	20, 19, 0.9
122	20	9	0.8	20, 9, 0.8
123	21	18	0.8	21, 18, 0.8
124	23	8	0.9	23, 8, 0.9
125.	25.	5	0.1	25, 5, 0.1