
بسم الله الرحمن الرحيم

Test Case Design Through Black Box

(Continue)

Boundary Value Analysis (BVA)

(Test Data)

Boundary Value Analysis (BVA)

- Greater number of errors tends to occur at the boundaries of the input domain than in the center
- Uses same principal
  - Inputs & Outputs grouped into Classes
- Elements are selected such that each edge of the E.C. is subject of a test (Boundaries are always a good place to look for defects)

Boundary Value Analysis (BVA)

- Boundaries mark the point or zone of transition from one equivalence class to another.
- The program is more likely to fail at a boundary, so these are the best members of (simple, numeric) equivalence classes to use.
- If software can operate on the edge of its capabilities, it will almost certainly operate well under normal conditions.

Boundary Value Analysis (BVA)

- B.V.A. focuses on testing of values from the boundary of the class.
- Design a test case for the boundary value.
- Design a test case for one significant value on either side of the boundary.

Boundary Value Analysis (BVA)

- **E.C.P. and B.V.A. can be used together.**
- **Input: range of values**
  - Test Cases (valid) for the ends of the range
  - Test Cases (invalid) for conditions just beyond the ends
- **Example of BVA**
  - Input (real number- Range): 0.0 - 90.0. i.e. (0.0, 0.1, 0.2, 0.3…90.0)
    - Test Cases
      - **Valid**
        - 0.0, 90.0,
      - Invalid
        - -1, 90.001

Boundary Value Analysis (BVA)

- **Input: number of values**
  - Test Cases (maximum and minimum number of values)
  - One beneath and beyond these values
- **Example of BVA**
  - Input (file can contain 1-255 records)
    - Test Cases
      - **Valid**
        - 1, 255
      - **Invalid**
        - 0, 256 records.

Boundary Value Analysis (BVA)

- **Types of Boundary conditions**
  - Numeric, position, quantity, speed, location, size
- **Also, extremes**
  - first/last, min/max, start/finish, over/under, empty/full,

    Shortest/longest, slowest/fastest, largest/smallest

Boundary Value Analysis (BVA)

- **Use these guidelines for each output condition**
  - **Output: Monthly Deduction**
    - Minimum = 0.0, Maximum = 3500.50
  - **Test Cases to cause**
    - Valid
      - 0.0 deduction and 3500.50 deduction
    - If possible to design test cases to have negative deduction and deduction larger than 3500.50.
    - Invalid
      - -1 deduction and 3500.51 deduction

Boundary Value Analysis

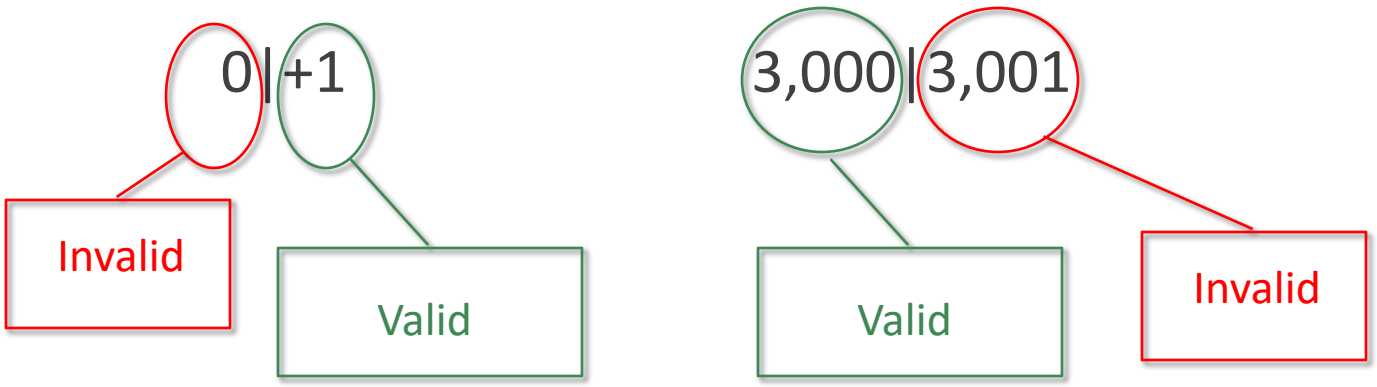
(Example)

Boundary Value Analysis (BVA)

- **Employees of an organization are allowed to get accommodation expenses while traveling on official tours.**
- **The program for validating expenses claims for accommodation has the following requirements**
  - There is an upper limit of Rs. 3,000 for accommodation expense claims
  - Any claim above Rs. 3,000 should be rejected and cause an error message to be displayed
  - All expense amounts should be greater than zero and an error message to be displayed if this is not the case

Boundary Value Analysis (BVA)

- **Inputs: Accommodation Expense**
- **Boundaries of the Input Values**
- **Better to show Boundaries Graphically**
  - Boundary: 0 < Expense ≤ 3,000



Boundary Value Analysis (BVA)

B.A. Example

Inputs

Test	Expenses	Boundary	Expected Output
1	-1	0	Error Msg
2	0	0	Error Msg
3	1	0	OK
4	2,900	3,000	OK
5	3,000	3,000	OK
6	3,001	3,000	Error Msg

Error Guessing

Error Guessing

- **Just 'guess' where the errors are ……**
- **Intuition and experience of tester**
- **Ad hoc, not really a technique**
- **Strategy:**
  - Make a list of possible errors or error-prone situations (often related to boundary conditions)
  - Write test cases based on this list

Error Guessing

- Most common error–prone situations (risk analysis).
- Try to identify critical parts of program (high risk sections).
- Parts with unclear specifications.
- Developed by junior programmer while he has problems.
- Complex specification and code.
- High-risk code will be more thoroughly tested.

Error Guessing

- **Defects' histories are useful**
- **Some items to try are:**
  - Empty or null lists/strings
  - Blanks or null characters in strings
  - Negative numbers
- **"Probability of errors remaining in the program is proportional to the number of errors that have been found so far"**

Black Box Testing

- **Black-box test data generation techniques.**
  - Equivalence partitioning
  - Boundary value analysis
  - Error guessing

Which one to Use ?

Black Box Testing

- **Which one to use ?**
  - None is complete
  - All are based on some kind of heuristics
  - They are complementary
  - **Always use a combination of methods**

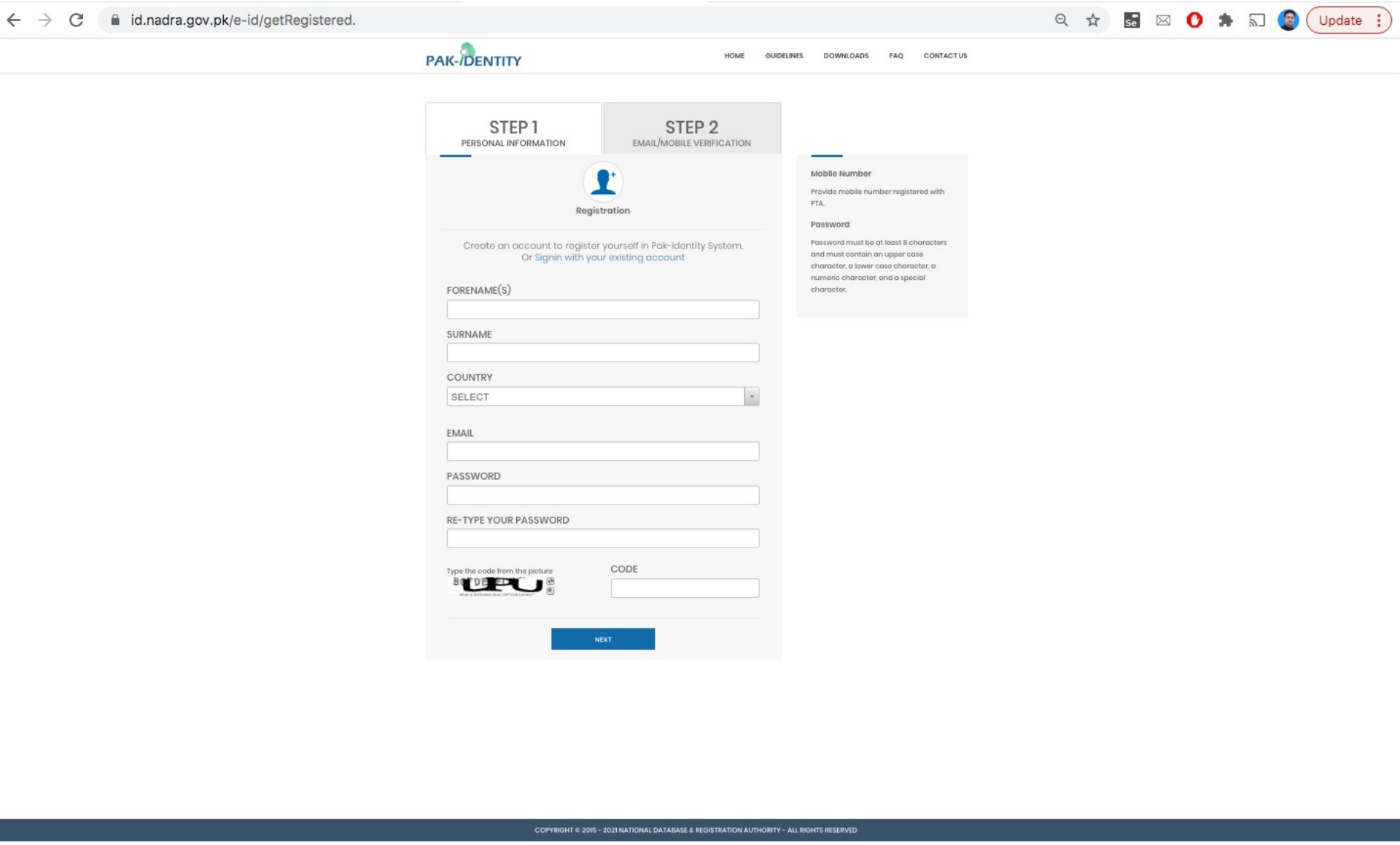
Practical Example of Testing

Practical Example

- **A person wants to "Create a New PAK IDENTITY Account" through NADRA online system i.e. *https://id.nadra.gov.pk/e-id/getRegistered*.**
- **There are multiple fields, which need to be filled for successful registration.**
  - **FR # 01: "Forename(s)"**
    - User shall be able to add only alphabets for their forename's. If user enters numeric then the system should show "*Invalid Characters*" error.
  - **FR # 02: "Surname"**
    - User shall be able to add only alphabets for their surname. If user enters numeric then the system should show "*Invalid Characters*" error.
  - **FR # 03: "Email"**
    - User shall be able to add only valid email id format. If user enters invalid email format then the system should give the "*Invalid Email Address!*" error.
  - **FR# 04: "Re-type Your Email"**
    - User shall be able enter same email id that he/she have entered before for validation. If email id is not matched with previous one then "*Email does not match*" error should be displayed.

Practical Example..Cont

- **FR # 05: "Primary Contact Number"**
  - For primary contact number user should select his/her country then should enter his/her phone #. User should not be able to enter alphabets in phone number. If user enters alphabets then system should give "*Only digits allowed and first character cannot be zero. Invalid Characters*" error. Along with that the first digit cannot be "0"
- **FR # 06: "Mobile Operators"**
  - User must select his/her mobile operator. E.g. ufone, mobilink etc. through radio button.
- **FR # 07: "Password"**
  - User should enter a strong password e.g. Alpha@642@211, and the system should indicate a weak, good & strong message for password strength. Password must be at least 8 characters long and must contain an upper case character, a lower case character, a numeric, and a special character i.e. !@#$%^&*(), if not, then system should give an error message i.e. "*Password must be at least 8 characters and must contain an upper case character, a lower case character, a numeric character, and a special character !@#$%^&*()*"
- **FR # 08: "Re-type Your Password"**
  - User should enter the same password as entered before or else system should give "*Password does not match*" error message
- **FR # 09: "captcha, agree, save & continue"**
  - User will then enter captcha, then will check on agree check box and then will click on "Save & Continue" button. If some thing is missing or invalid e.g. captcha the form will not continue.


id.nadra.gov.pk/e-id/getRegistered.
Update
PAK-IDENTITY
HOME
GUIDELINES
DOWNLOADS
FAQ
CONTACT US
STEP 1
PERSONAL INFORMATION
STEP 2
EMAIL/MOBILE VERIFICATION
Registration
Create an account to register yourself in Pak-Identity System.
Or Signin with your existing account
FORENAME(S)
SURNAME
COUNTRY
SELECT
EMAIL
PASSWORD
RE-TYPE YOUR PASSWORD
Type the code from the picture
CODE
NEXT
Mobile Number
Provide mobile number registered with PTA.
Password
Password must be at least 8 characters and must contain an upper case character, a lower case character, a numeric character, and a special character.
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Practical Example

(Possible Solution)

Test Data FR # 01

- **FR # 01: “Forename(s)”**
  - User shall be able to add only alphabets for their forename's. If user enters numeric then the system should show “*Invalid Characters*” error.

Inputs: Forename

Partition the Input Values (ECP):

Valid:

{a,b,c,d,….z}

Invalid:

Outside valid

Test Case FR # 01

Test Case ID	1	2
Input	hasnain	123
Partition Tested	{a, b, c, d,….z}	Outside valid
Expected Output	Name Entered Successfully	*Invalid Characters*
Actual Output	“	“

Test Data FR # 02

- **FR # 02: "Surname"**
  - User shall be able to add only alphabets for their surname. If user enters numeric then the system should show "*Invalid Characters*" error.

Inputs: Surname

Partition the Input Values (ECP):

Valid:

{a,b,c,d,….z}

Invalid:

Outside valid

Test Case FR # 02

Test Case ID	**3**	**4**
Input	Abbas	@ABBAS
Partition Tested	{a, b, c, d,….z}	Outside valid
Expected Output	Name Entered Successfully	*Invalid Characters*
Actual Output	“	“

Test Data FR # 03

- **FR # 03: "Email"**
  - User shall be able to add only valid email id format. If user enters invalid email format then the system should give the "*Invalid Email Address!*" error.

Inputs: Email id

Partition the Input Values (ECP):

Valid

Valid Email address	Reason
email@domain.com	Valid email
firstname.lastname@domain.com	Email contains dot in the address field
email@subdomain.domain.com	Email contains dot with subdomain
firstname+lastname@domain.com	Plus sign is considered valid character
email@123.123.123.123	Domain is valid IP address
email@[123.123.123.123]	Square bracket around IP address is considered valid
"email"@domain.com	Quotes around email is considered valid
1234567890@domain.com	Digits in address are valid
email@domain-one.com	Dash in domain name is valid
_____@domain.com	Underscore in the address field is valid
email@domain.name	.name is valid Top Level Domain name
email@domain.co.jp	Dot in Top Level Domain name also considered valid (use co.jp as example here)
firstname-lastname@domain.com	Dash in address field is valid

In Valid

Invalid Email address	Reason
plainaddress	Missing @ sign and domain
#@%^%#$@#$@#.com	Garbage
@domain.com	Missing username
Joe Smith <email@domain.com>	Encoded html within email is invalid
email.domain.com	Missing @
email@domain@domain.com	Two @ sign
.email@domain.com	Leading dot in address is not allowed
email.@domain.com	Trailing dot in address is not allowed
email..email@domain.com	Multiple dots
あいうえお@domain.com	Unicode char as address
email@domain.com (Joe Smith)	Text followed email is not allowed
email@domain	Missing top level domain (.com/.net/.org/etc)
email@-domain.com	Leading dash in front of domain is invalid
email@domain.web	.web is not a valid top level domain
email@111.222.333.44444	Invalid IP format
email@domain..com	Multiple dot in the domain portion is invalid

Test Case FR # 03

Test Case ID	5	6
Input	hasnain@yahoo.com	Hasnain.yahoo.com
Partition Tested	Valid (as shown in image)	Outside valid (as shown in image)
Expected Output	Email Entered Successfully	*Invalid Email Address!*
Actual Output	“	“

Test Data FR # 05

- **FR # 05: “Primary Contact Number”**
  - For primary contact number user should select his/her country then should enter his/her phone #. User should not be able to enter alphabets in phone number. If user enters alphabets then system should give "*Only digits allowed and first character cannot be zero. Invalid Characters*” error. Along with that the first digit cannot be “0”.

Inputs: Primary Contact Number

Partition the Input Values (BVA):

Valid:

{0,1,2,3,4,5,6,7,8,9}

Digit length $\leq$ 12

First Digit $\neq$ 0

Invalid:

Outside valid

Test Case FR # 05

Test Case ID	7	8
Input	+92331765456	+92asdhasdh
Partition Tested	{0,1,2,3,4,5,6,7,8,9} Digit length < 12 First Digit = 0	Outside valid
Expected Output	Email Entered Successfully	*Only digits allowed and first character cannot be zero. Invalid Characters*
Actual Output	“	“

Test Data FR # 07

- **FR # 07: "Password"**
  - User should enter a strong password e.g. hasnain@896@211, and the system should indicate a weak, good & strong message for password strength. Password must be at least 8 characters long and must contain an upper case character, a lower case character, a numeric, and a special character i.e. !@#$%^&*(), if not, then system should give an error message i.e. "*Password must be at least 8 characters and must contain an upper case character, a lower case character, a numeric character, and a special character !@#$%^&*()*".
- Inputs: Password

Partition the Input Values (ECP):

Valid:

characters Length ≥8
{0, 1,2, 3 ,4, 5,6 ,7 ,8 ,9}
Minimum 1 upper case character
Minimum 1 lower case character
Minimum 1 special character (!@#$%^&*()

Invalid:

Outside valid

Test Case FR # 05

Test Case ID	9	10
Input	Hasnain@2018	hasnain
Partition Tested	characters>=8 1 upper case character 1 lower case character 1 special character (!@#$%^&*()	Outside valid
Expected Output	Password Entered Successfully	*Password must be at least 8 characters and must contain an upper case character, a lower case character, a numeric character, and a special character !@#$%^&*(*
Actual Output	“	“

Test Data Retype Password

Inputs: Re Type Password

Partition the Input Values (ECP):

Valid:

Same as Password

Invalid:

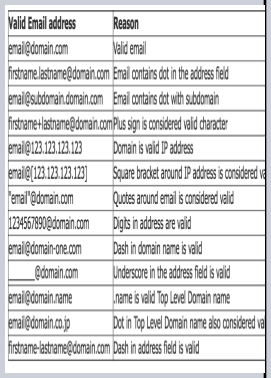
Outside valid

Test Case

Test Case ID	22	23
Input	“Re Type Password”	“Type Mismatch Password”
Partition Tested	Same as password	Outside valid
Expected Output	Password Entered Successfully	*Passwords do not match*
Actual Output	“	“

How To Represent Multiple Test Cases Which Are Dependent On Each Other ?

Test Case (Valid)

Test Case ID	11				
Input	Hasnain	Abbas	hasnain@yahoo.com	+92331765456	Home@2018
Partition Tested	{a, b, c, d,….z}	{a, b, c, d,….z}		{0,1,2,3,4,5,6,7,8,9}	characters>=8 1 upper case character 1 lower case character 1 special character (!@#$%^&*()
Expected Output	No error	No error	No error	No error	Data Entered Successfully
Actual Output	“	“	“	“	“

Valid Email address	Reason
email@domain.com	Valid email
firstname.lastname@domain.com	Email contains dot in the address field
email@subdomain.domain.com	Email contains dot with subdomain
firstname+lastname@domain.com	Plus sign is considered valid character
email@123.123.123.123	Domain is valid IP address
email@[123.123.123.123]	Square bracket around IP address is considered va
"email"@domain.com	Quotes around email is considered valid
1234567890@domain.com	Digits in address are valid
email@domain-one.com	Dash in domain name is valid
_____@domain.com	Underscore in the address field is valid
email@domain.name	.name is valid Top Level Domain name
email@domain.co.jp	Dot in Top Level Domain name also considered va
firstname-lastname@domain.com	Dash in address field is valid

Test Case (Invalid)

Test Case ID	12				
Input	Hasnain123	Abbas123	Hasnain.abbas.com	+92317hasnain	hasnain
Partition Tested	Outside Valid	Outside Valid	Outside Valid	Outside Valid	Outside Valid
Expected Output	*Invalid Characters*	*Invalid Characters*	*Invalid Email Address!*	*Only digits allowed and first character cannot be zero. Invalid Characters*	*Password must be at least 8 characters and must contain an upper case character, a lower case character, a numeric character, and a special character !@#$%^&*(*
Actual Output	“	“	“	“	“

Test Case (Valid & Invalid)

Test Case ID	13						
Input	Hasnain123	Abbas123	Hasnain	Hasnain.abbas.com	+923317654 56	+92317hasnain	hasnain
Partition Tested	Outside Valid	Outside Valid	{a, b, c, d,….z}	Outside Valid	{0,1,2,3,4,5,6,7,8,9}	Outside Valid	Outside Valid
Expected Output	*Invalid Characters*	*Invalid Characters*	No error	*Invalid Email Address!*	No error	*Only digits allowed and first character cannot be zero. Invalid Characters*	*Password must be at least 8 characters and must contain an upper case character, a lower case character, a numeric character, and a special character !@#$%^&*(*
Actual Output	“	“	“	“	“	“	“

Lets Test These Test Cases Manually

Test Case (Valid)

Test Case ID	11				
Input	Hasnain (FORENAME(S))	Abbas (SURNAME)	hasnain@yahoo.com (Email)	+92331765456 (Phone)	Home@2018 (PASSWORD)
Partition Tested	{a, b, c, d,….z}	{a, b, c, d,….z}		{0,1,2,3,4,5,6,7,8,9}	characters>=8 1 upper case character 1 lower case character 1 special character (!@#$%^&*()
Expected Output	No error	No error	No error	No error	Data Entered Successfully
Actual Output	“	“	“	“	“
P/F (Pass/Fail)					

Valid Email address	Reason
email@domain.com	Valid email
firstname.lastname@domain.com	Email contains dot in the address field
email@subdomain.domain.com	Email contains dot with subdomain
firstname+lastname@domain.com	Plus sign is considered valid character
email@123.123.123.123	Domain is valid IP address
email@[123.123.123.123]	Square bracket around IP address is considered va
"email"@domain.com	Quotes around email is considered valid
1234567890@domain.com	Digits in address are valid
email@domain-one.com	Dash in domain name is valid
_____@domain.com	Underscore in the address field is valid
email@domain.name	.name is valid Top Level Domain name
email@domain.co.jp	Dot in Top Level Domain name also considered val
firstname-lastname@domain.com	Dash in address field is valid

Test Case (In Valid)

Test Case ID	11				
Input	Hasnain123 (FORENAME(S))	Abbas123 (SURNAME)	Hasnain.abbas.com (EMAIL)	+92317hasnain	Hasnain (PASSWORD)
Partition Tested	Outside Valid	Outside Valid	Outside Valid	Outside Valid	Outside Valid
Expected Output	*Invalid Characters*	*Invalid Characters*	*Invalid Email Address!*	*Only digits allowed and first character cannot be zero. Invalid Characters*	*Password must be at least 8 characters and must contain an upper case character, a lower case character, a numeric character, and a special character !@#$%^&*(*
Actual Output					
P/F (Pass/Fail)					

Testing Automation Tools

(Selenium IDE & Katalon)

Selenium - History

- **Developed in 2004 by Jason Huggins as a JavaScript library used to automate his manual testing routines.**

- **In 2008, Selenium and WebDriver merged technologies and intellectual intelligence to provide the best possible test automation framework.**

Selenium IDE

- **Open source record and playback test automation for the web.**
- **Selenium IDE is a portable framework for testing web applications.**
- **Selenium IDE is a Chrome and Firefox plugin which records and plays back user interactions with the browser.**

Selenium IDE

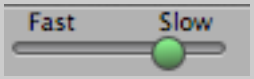
- Has a recording feature that records a user's live actions that can be exported in one of many programming languages.

- Use this to either create simple scripts.

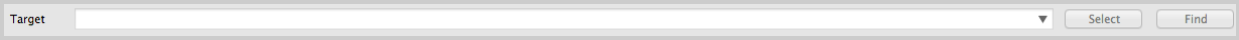
- Selenium can be extended through the use of plugins.

- Only for web.

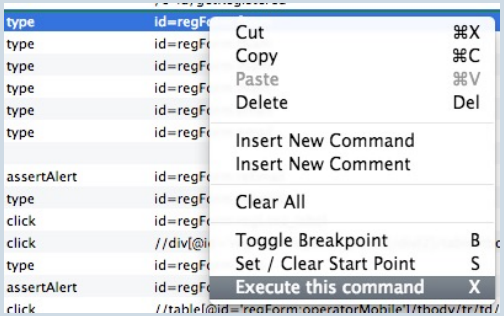
Selenium IDE – Basics

Play Entire Test Suite	
Play Current Test Case	
Pause/Resume	
Recording	
Value	
Test Case/Suite Speed	

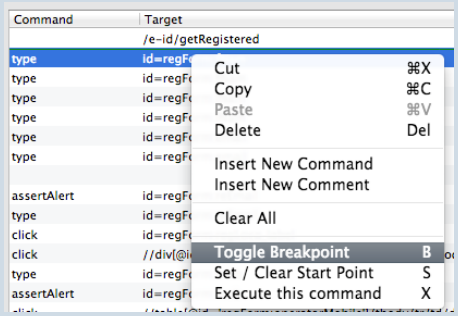
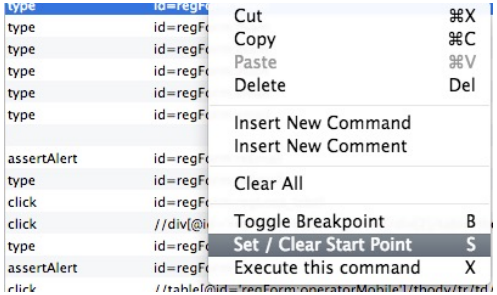
Selenium IDE – Basics

Command	
Target	

Selenium IDE – Commands (Examples)

Command	Functionality
Execute This Command (x) 	Execute This Specific Command Only
captureScreenshot	The screenshot is displayed in the "Screenshot tab". From there, you can export it.

Selenium IDE – Commands (Examples)

Command	Functionality
Toggle Breakpoint (b) 	Stop Here
Set/Clear Start Point (s) 	Start From Here

Selenium IDE – Commands

- **Selenium IDE Commands (pdf)**

Lets Test These Test Cases Through Automation

(Selenium IDE)