The class diagram depicts a static view of an application. It represents the types of objects residing in the system and the relationships between them. A class consists of its objects, and also it may inherit from other classes. A class diagram is used to visualize, describe, document various different aspects of the system, and also construct executable software code.

It shows the attributes, classes, functions, and relationships to give an overview of the software system. It constitutes class names, attributes, and functions in a separate compartment that helps in software development. Since it is a collection of classes, interfaces, associations, collaborations, and constraints, it is termed as a structural diagram.

Purpose of Class Diagrams

The main purpose of class diagrams is to build a static view of an application. It is the only diagram that is widely used for construction, and it can be mapped with object-oriented languages. It is one of the most popular UML diagrams. Following are the purpose of class diagrams given below:

1. It analyses and designs a static view of an application.
2. It describes the major responsibilities of a system.
3. It is a base for component and deployment diagrams.
4. It incorporates forward and reverse engineering.

Benefits of Class Diagrams

1. It can represent the object model for complex systems.
2. It reduces the maintenance time by providing an overview of how an application is structured before coding.
3. It provides a general schematic of an application for better understanding.
4. It represents a detailed chart by highlighting the desired code, which is to be programmed.
5. It is helpful for the stakeholders and the developers.

Vital components of a Class Diagram

The class diagram is made up of three sections:

o **Upper Section:** The upper section encompasses the name of the class. A class is a representation of similar objects that shares the same relationships, attributes, operations, and semantics. Some of the following rules that should be taken into account while representing a class are given below:

1. Capitalize the initial letter of the class name.

1. Place the class name in the center of the upper section.

1. A class name must be written in bold format.

1. The name of the abstract class should be written in italics format.

o **Middle Section:** The middle section constitutes the attributes, which describe the quality of the class. The attributes have the following characteristics:

1. The attributes are written along with its visibility factors, which are public (+), private (-), protected (#), and package (~).

1. The accessibility of an attribute class is illustrated by the visibility factors.

1. A meaningful name should be assigned to the attribute, which will explain its usage inside the class.

o **Lower Section:** The lower section contain methods or operations. The methods are represented in the form of a list, where each method is written in a single line. It demonstrates how a class interacts with data.

ClassName
attributes
methods
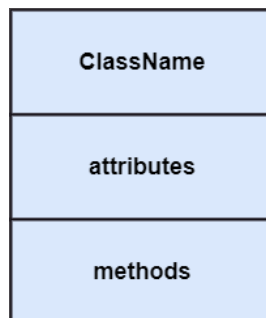
Relationships

In UML, relationships are of three types:

o **Dependency:** A dependency is a semantic relationship between two or more classes where a change in one class cause changes in another class. It forms a weaker relationship.
In the following example, Student_Name is dependent on the Student_Id.

Student_Name	----→	Student_Id
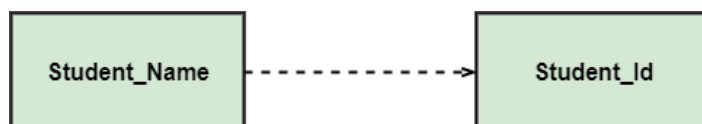
o **Generalization:** A generalization is a relationship between a parent class (superclass) and a child class (subclass). In this, the child class is inherited from the parent class.
For example, The Current Account, Saving Account, and Credit Account are the generalized form of Bank Account.

Bank Account

Current Account — Saving Account — Credit Account
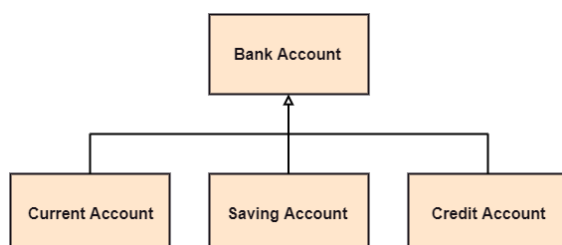
o **Association:** It describes a static or physical connection between two or more objects. It depicts how many objects are there in the relationship.
For example, a department is associated with the college.

Department —— College

Multiplicity: It defines a specific range of allowable instances of attributes. In case if a range is not specified, one is considered as a default multiplicity.

For example, multiple patients are admitted to one hospital.
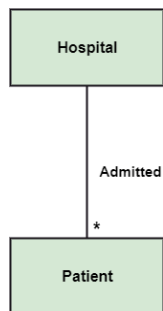
Aggregation: An aggregation is a subset of association, which represents has a relationship. It is more specific then association. It defines a part-whole or part-of relationship. In this kind of relationship, the child class can exist independently of its parent class.

The company encompasses a number of employees, and even if one employee resigns, the company still exists.
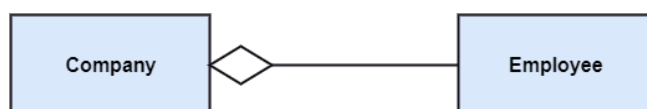
Composition: The composition is a subset of aggregation. It portrays the dependency between the parent and its child, which means if one part is deleted, then the other part also gets discarded. It represents a whole-part relationship.

A contact book consists of multiple contacts, and if you delete the contact book, all the contacts will be lost.

Abstract Classes

In the abstract class, no objects can be a direct entity of the abstract class. The abstract class can neither be declared nor be instantiated. It is used to find the functionalities across the classes. The notation of the abstract class is similar to that of class; the only difference is that the name of the class is written in italics. Since it does not involve any implementation for a given function, it is best to use the abstract class with multiple objects.

Let us assume that we have an abstract class named **displacement** with a method declared inside it, and that method will be called as a **drive ()**. Now, this abstract class method can be implemented by any object, for example, car, bike, scooter, cycle, etc.

| Displacement |
| --- |
| +drive(): void |
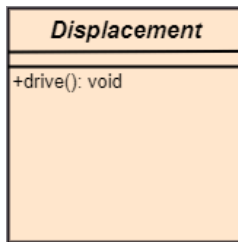
How to draw a Class Diagram?

The class diagram is used most widely to construct software applications. It not only represents a static view of the system but also all the major aspects of an application. A collection of class diagrams as a whole represents a system.

Some key points that are needed to keep in mind while drawing a class diagram are given below:

1. To describe a complete aspect of the system, it is suggested to give a meaningful name to the class diagram.
2. The objects and their relationships should be acknowledged in advance.
3. The attributes and methods (responsibilities) of each class must be known.
4. A minimum number of desired properties should be specified as more number of the unwanted property will lead to a complex diagram.
5. Notes can be used as and when required by the developer to describe the aspects of a diagram.
6. The diagrams should be redrawn and reworked as many times to make it correct before producing its final version.

Class Diagram Example

A class diagram describing the sales order system is given below.
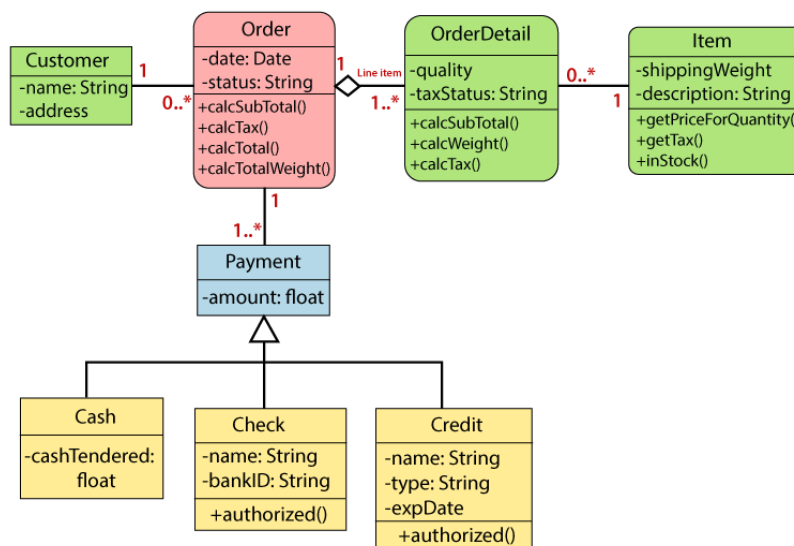

Usage of Class diagrams

The class diagram is used to represent a static view of the system. It plays an essential role in the establishment of the component and deployment diagrams. It helps to construct an executable code to perform forward and backward engineering for any system, or we can say it is mainly used for

construction. It represents the mapping with object–oriented languages that are C++, Java, etc. Class diagrams can be used for the following purposes:

1. To describe the static view of a system.
2. To show the collaboration among every instance in the static view.
3. To describe the functionalities performed by the system.
4. To construct the software application using object–oriented languages.
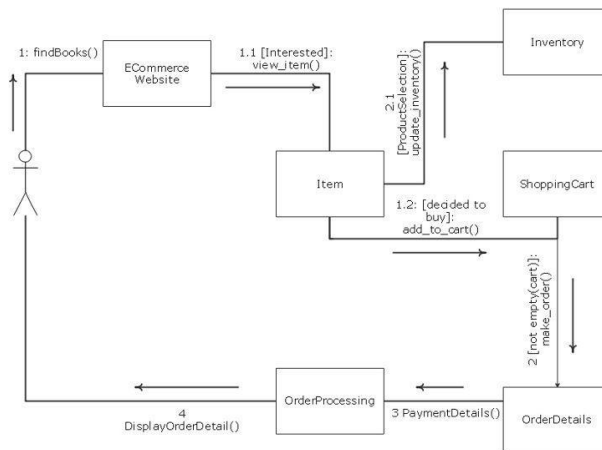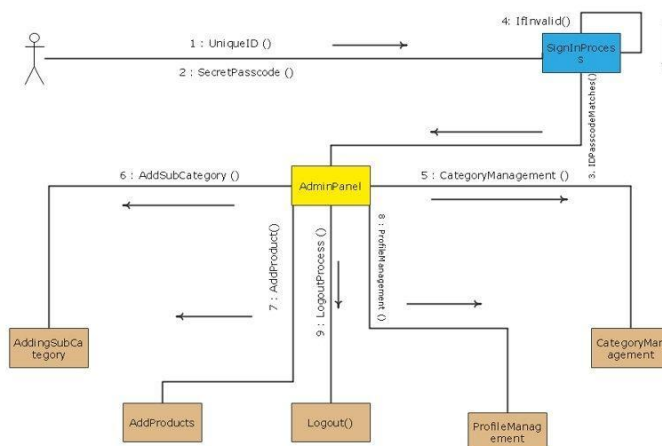

Sequence Diagrams - https://creately.com/guides/sequence-diagram-tutorial/
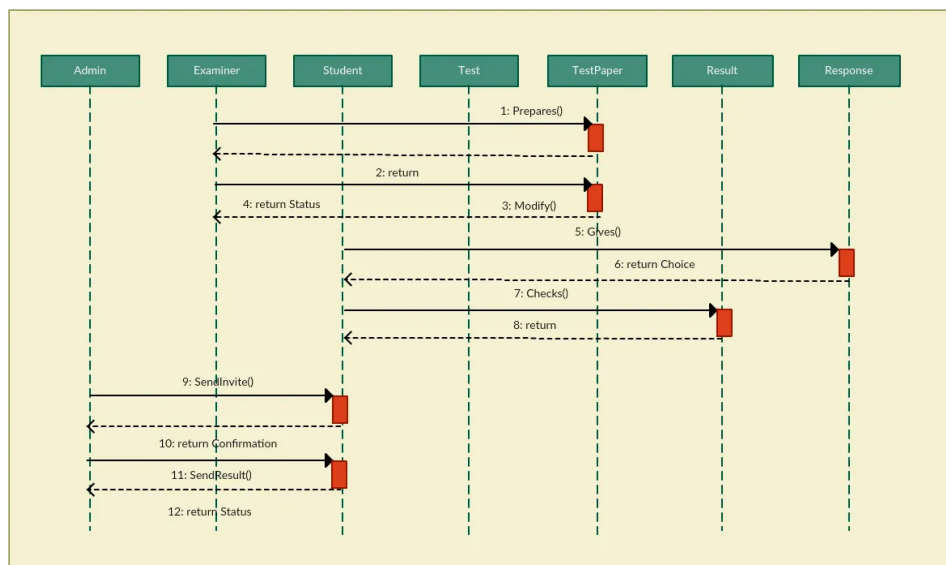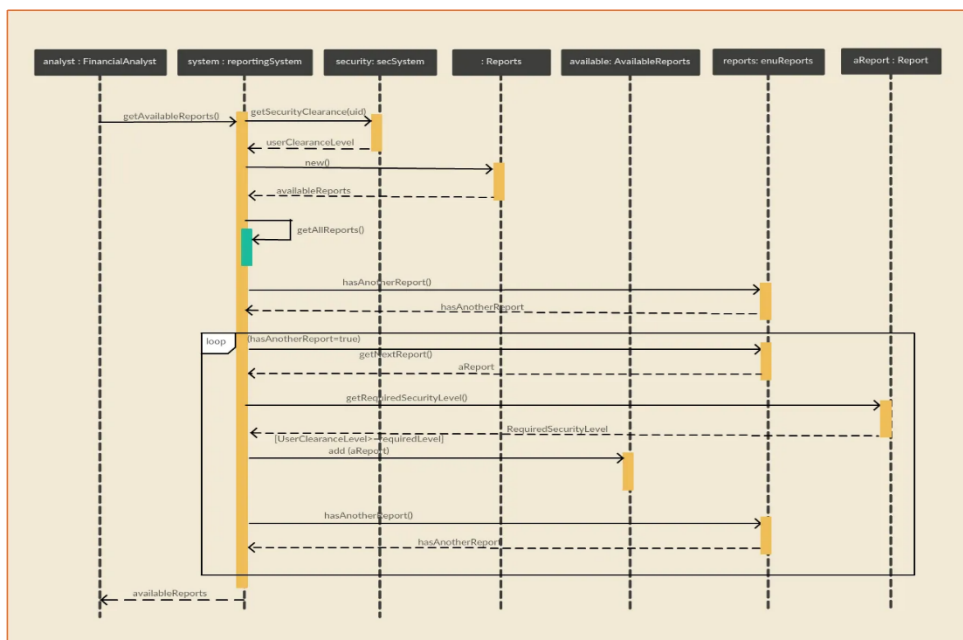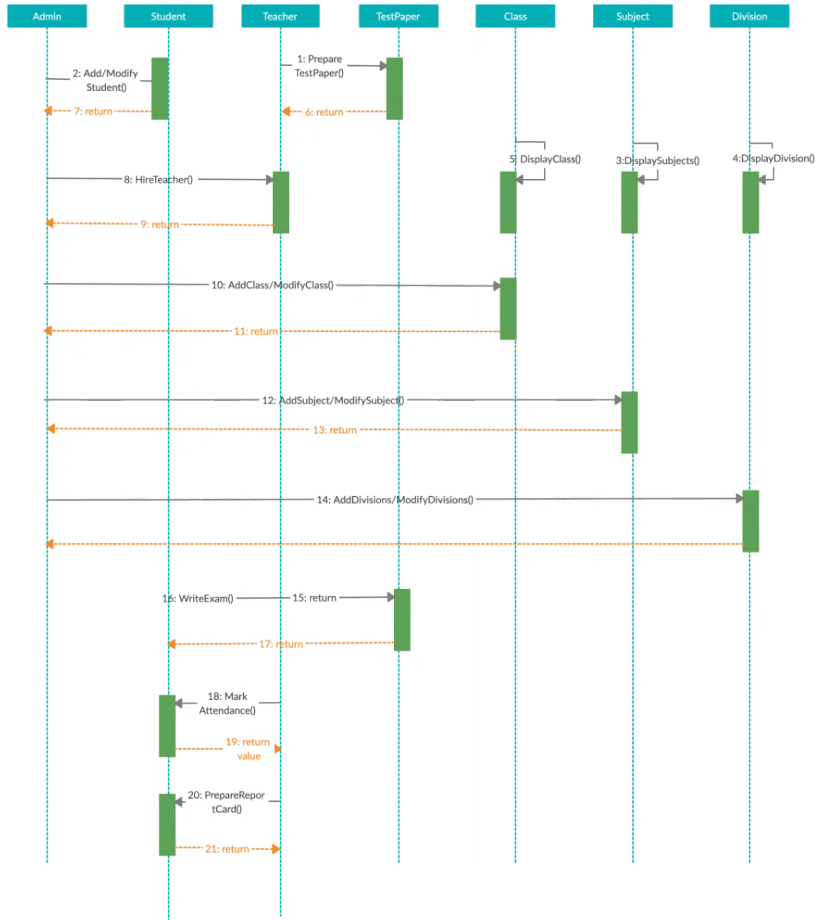
Collaboration Diagram Example

**Collaboration Diagram
For Purchase Journey on Ecommerce Wesite**

**Collaboration Diagram
For AdminPanel**

UML Activity Diagram

In UML, the activity diagram is used to demonstrate the flow of control within the system rather than the implementation. It models the concurrent and sequential activities.

The activity diagram helps in envisioning the workflow from one activity to another. It put emphasis on the condition of flow and the order in which it occurs. The flow can be sequential, branched, or concurrent, and to deal with such kinds of flows, the activity diagram has come up with a fork, join, etc.

It is also termed as an object–oriented flowchart. It encompasses activities composed of a set of actions or operations that are applied to model the behavioral diagram.

Components of an Activity Diagram

Following are the component of an activity diagram:

Activities

The categorization of behavior into one or more actions is termed as an activity. In other words, it can be said that an activity is a network of nodes that are connected by edges. The edges depict the flow of execution. It may contain action nodes, control nodes, or object nodes.

The control flow of activity is represented by control nodes and object nodes that illustrates the objects used within an activity. The activities are initiated at the initial node and are terminated at the final node.
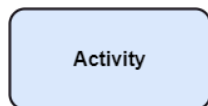

Activity partition /swimlane

The swimlane is used to cluster all the related activities in one column or one row. It can be either vertical or horizontal. It used to add modularity to the activity diagram. It is not necessary to incorporate swimlane in the activity diagram. But it is used to add more transparency to the activity diagram.
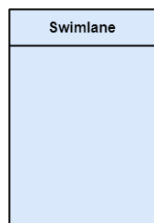
Forks

Forks and join nodes generate the concurrent flow inside the activity. A fork node consists of one inward edge and several outward edges. It is the same as that of various decision parameters. Whenever a data is received at an inward edge, it gets copied and split crossways various outward edges. It split a single inward flow into multiple parallel flows.
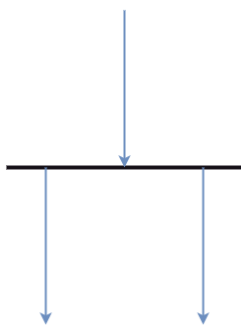
Join Nodes

Join nodes are the opposite of fork nodes. A Logical AND operation is performed on all of the inward edges as it synchronizes the flow of input across one single output (outward) edge.
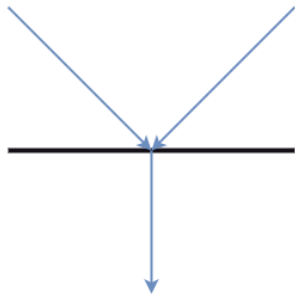
Pins

It is a small rectangle, which is attached to the action rectangle. It clears out all the messy and complicated thing to manage the execution flow of activities. It is an object node that precisely represents one input to or output from the action.

Notation of an Activity diagram

Activity diagram constitutes following notations:

Initial State: It depicts the initial stage or beginning of the set of actions.

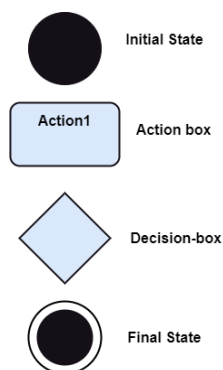**Final State:** It is the stage where all the control flows and object flows end.

Decision Box: It makes sure that the control flow or object flow will follow only one path.

Action Box: It represents the set of actions that are to be performed.

Why use Activity Diagram?

An event is created as an activity diagram encompassing a group of nodes associated with edges. To model the behavior of activities, they can be attached to any modeling element. It can model use cases, classes, interfaces, components, and collaborations.

It mainly models processes and workflows. It envisions the dynamic behavior of the system as well as constructs a runnable system that incorporates forward and reverse engineering. It does not include the message part, which means message flow is not represented in an activity diagram.

It is the same as that of a flowchart but not exactly a flowchart itself. It is used to depict the flow between several activities.

How to draw an Activity Diagram?

An activity diagram is a flowchart of activities, as it represents the workflow among various activities. They are identical to the flowcharts, but they themself are not exactly the flowchart. In other words, it can be said that an activity diagram is an enhancement of the flowchart, which encompasses several unique skills.

Since it incorporates swimlanes, branching, parallel flows, join nodes, control nodes, and forks, it supports exception handling. A system must be explored as a whole before drawing an activity diagram to provide a clearer view of the user. All of the activities are explored after they are properly analyzed for finding out the constraints applied to the activities. Each and every activity, condition, and association must be recognized.

After gathering all the essential information, an abstract or a prototype is built, which is then transformed into the actual diagram.

Following are the rules that are to be followed for drawing an activity diagram:

1. A meaningful name should be given to each and every activity.
2. Identify all of the constraints.
3. Acknowledge the activity associations.

Example of an Activity Diagram

An example of an activity diagram showing the business flow activity of order processing is given below.

Here the input parameter is the Requested order, and once the order is accepted, all of the required information is then filled, payment is also accepted, and then the order is shipped. It permits order shipment before an invoice is sent or payment is completed.
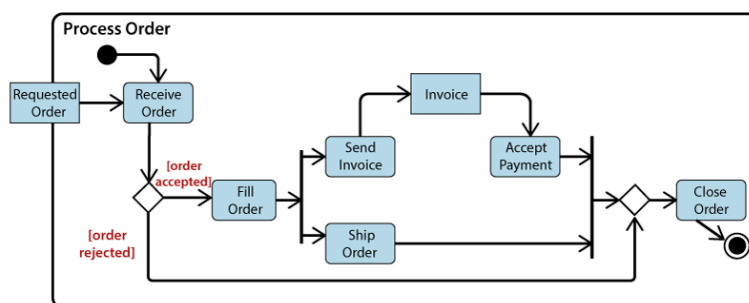
When to use an Activity Diagram?

An activity diagram can be used to portray business processes and workflows. Also, it used for modeling business as well as the software. An activity diagram is utilized for the followings:

1. To graphically model the workflow in an easier and understandable way.
2. To model the execution flow among several activities.
3. To model comprehensive information of a function or an algorithm employed within the system.
4. To model the business process and its workflow.
5. To envision the dynamic aspect of a system.
6. To generate the top-level flowcharts for representing the workflow of an application.
7. To represent a high-level view of a distributed or an object-oriented system.

Start → Open Word Processing Package → Create File → Save File → Type the Document → [graphics needed] Open and Use Graphics Package / [graphics not needed] → [tables needed] Open and Use Spreadsheet / [tables not needed] → Save the File → Print Hard Copy → Exit Office Suite → End

2023 Payment Processing

UML Activity Diagram

Create Transaction → Fund Transfer → Provide Bank Deposit Details / Credit → Request Credit Account Details → Request Payment from Bank

Cash → Receive Cash → Print Payment Receipt → Return Payment Receipt → Complete Transaction

Confirm Payment Approval from Bank → Close Transaction

Cancel Transaction

Test Scenario ID	Login-1		Test Case ID	Login-1A	
Test Case Description	Login – Positive test case		Test Priority	High	
Pre-Requisite	A valid user account		Post-Requisite	NA	

Test Execution Steps:

S.No	Action	Inputs	Expected Output	Actual Output	Test Browser	Test Result	Test Comments
1	Launch application	https://www.facebook.com/	Facebook home	Facebook home	IE-11	Pass	[Priya 10/17/2017 11:44 AM]: Launch successful
2	Enter correct Email & Password and hit login button	Email id : test@xyz.com Password: ******	Login success	Login success	IE-11	Pass	[Priya 10/17/2017 11:45 AM]: Login successful

Test Scenario ID	Login-1		Test Case ID	Login-1B	
Test Case Description	Login – Negative test case		Test Priority	High	
Pre-Requisite	NA		Post-Requisite	NA	

Test Execution Steps:

S.No	Action	Inputs	Expected Output	Actual Output	Test Browser	Test Result	Test Comments
1	Launch application	https://www.facebook.com/	Facebook home	Facebook home	IE-11	Pass	[Priya 10/17/2017 11:44 AM]: Launch successful
2	Enter invalid Email & any Password and hit login button	Email id : invalid@xyz.com Password: ******	The email address or phone number that you've entered doesn't match any account. Sign up for an account.	The email address or phone number that you've entered doesn't match any account. Sign up for an account.	IE-11	Pass	[Priya 10/17/2017 11:45 AM]: Invalid login attempt stopped
3	Enter valid Email & incorrect Password and hit login button	Email id : valid@xyz.com Password: ******	The password that you've entered is incorrect. Forgotten password?	The password that you've entered is incorrect. Forgotten password?	IE-11	Pass	[Priya 10/17/2017 11:46 AM]: Invalid login attempt stopped