



LP-II Lab Manual 2022-23 Sem-II (1) (1) removed

Computer Engineering (Savitribai Phule Pune University)



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\Assignment No-01

Title: - Implement depth first search algorithm and Breadth First Search algorithm

Objectives:-

1. Understand the implementation of depth first search algorithm
2. Understand the implementation of Breadth First Search algorithm

Problem Statement:-

Implement depth first search algorithm and Breadth First Search algorithm, Use an undirected graph and develop a recursive algorithm for searching all the vertices of a graph or tree data structure

Software and Hardware requirements:-

1. **Operating system:** Linux- Ubuntu 16.04 to 17.10, or Windows 7 to 10,
2. **RAM-** 2GB RAM (4GB preferable)
3. You have to install **Python3** or higher version

Theory-

1. Depth First Search

The Depth-First Search is a recursive algorithm that uses the concept of backtracking. It involves thorough searches of all the nodes by going ahead if potential, else by backtracking. Here, the word backtrack means once you are moving forward and there are not any more nodes along the present path, you progress backward on an equivalent path to seek out nodes to traverse. All the nodes are progressing to be visited on the current path until all the unvisited nodes are traversed after which subsequent paths are going to be selected.

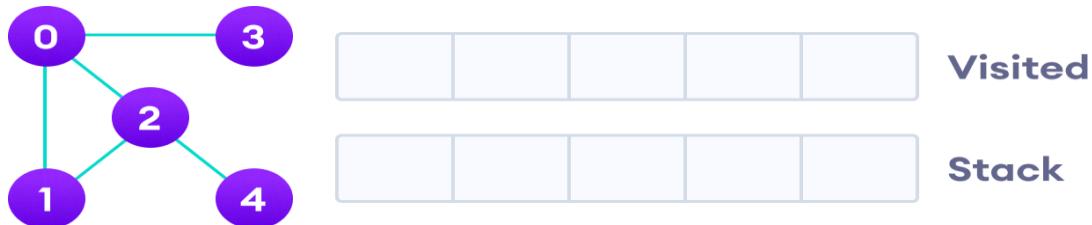
DFS Algorithm

The DSF algorithm follows as:

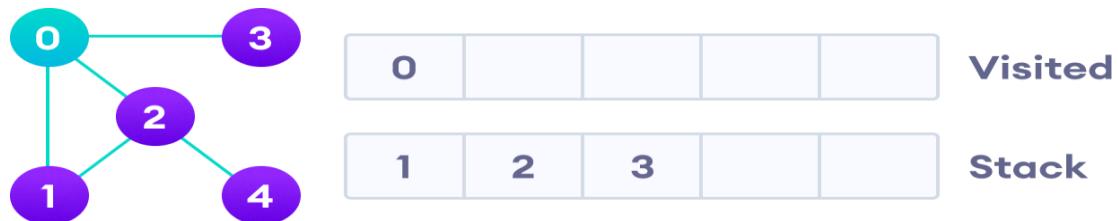
1. We will start by putting any one of the graph's vertex on top of the stack.
2. After that take the top item of the stack and add it to the visited list of the vertex.
3. Next, create a list of that adjacent node of the vertex. Add the ones which aren't in the visited list of vertexes to the top of the stack.
4. Lastly, keep repeating steps 2 and 3 until the stack is empty.

Depth First Search Example

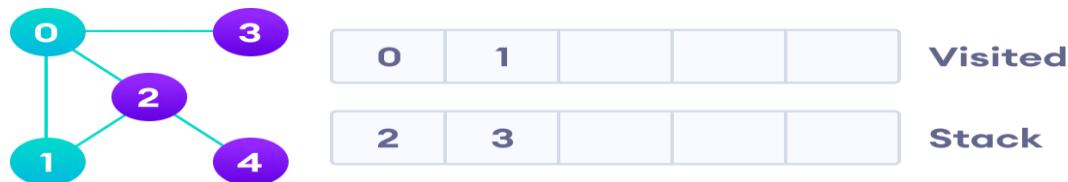
Let's see how the Depth First Search algorithm works with an example. We use an undirected graph with 5 vertices.



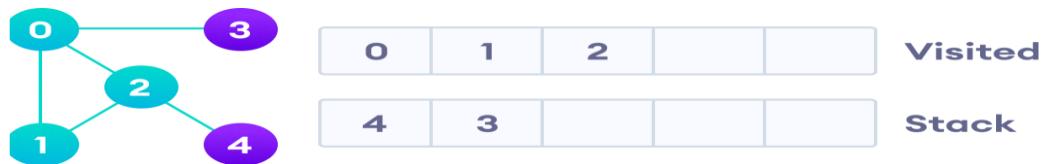
We start from vertex 0, the DFS algorithm starts by putting it in the Visited list and putting all its adjacent vertices in the stack.



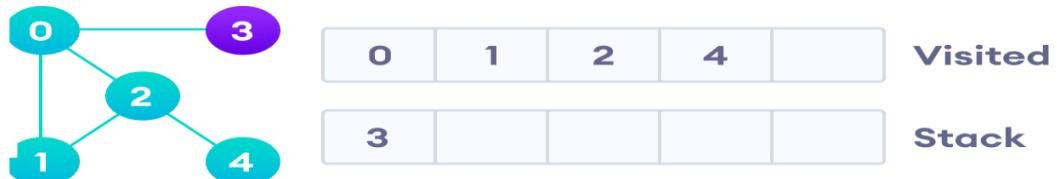
Next, we visit the element at the top of stack i.e. 1 and go to its adjacent nodes. Since 0 has already been visited, we visit 2 instead



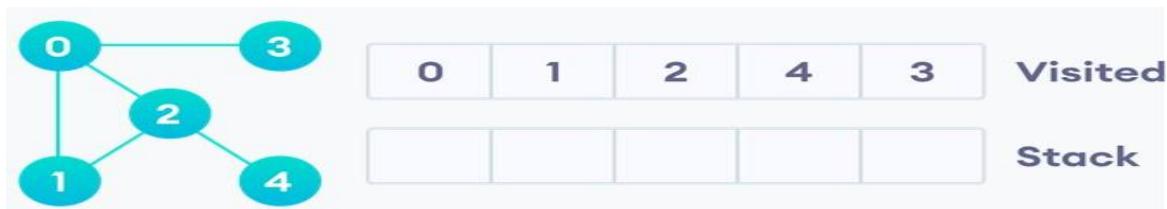
Vertex 2 has an unvisited adjacent vertex in 4, so we add that to the top of the stack and visit it.



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After we visit the last element 3, it doesn't have any unvisited adjacent nodes, so we have completed the Depth First Traversal of the graph.



After we visit the last element 3, it doesn't have any unvisited adjacent nodes, so we have completed the Depth First Traversal of the graph.

Application of DFS Algorithm

1. For finding the path
2. To test if the graph is bipartite
3. For finding the strongly connected components of a graph
4. For detecting cycles in a graph.

Breadth-First Search

Breadth-First Search (BFS) is an algorithm used for traversing graphs or trees. Traversing means visiting each node of the graph. Breadth-First Search is a recursive algorithm to search all the vertices of a graph or a tree. BFS in python can be implemented by using data structures like a dictionary and lists. Breadth-First Search in tree and graph is almost the same. The only difference is that the graph may contain cycles, so we may traverse to the same node again.

Explanation:

1. Create a graph.
2. Initialize a starting node.
3. Send the graph and initial node as parameters to the bfs function.
4. Mark the initial node as visited and push it into the queue.
5. Explore the initial node and add its neighbours to the queue and remove the initial node from the queue.
6. Check if the neighbours node of a neighbouring node is already visited.
7. If not, visit the neighbouring node neighbours and mark them as visited.
8. Repeat this process until all the nodes in a graph are visited and the queue becomes empty.

Advantages of BFS

1. It can be useful in order to find whether the graph has connected components or not.
2. It always finds or returns the shortest path if there is more than one path between two vertices.

Disadvantages of BFS

1. The execution time of this algorithm is very slow because the time complexity of this algorithm is exponential.
2. This algorithm is not useful when large graphs are used.

Conclusion

Depth-First Search and Breadth-First Search (BFS) are used to traverse the graph or tree. We implemented Depth-First Search and Breadth-First Search (BFS) in python for searching all the vertices of a graph or tree data structure.

Assignment No-02

Title: - Implement A star Algorithm for any game search problem.

Objectives:-

1. Understand the implementation of A star Algorithm

Problem Statement:-

Implement A star Algorithm for any game search problem.

Software and Hardware requirements:-

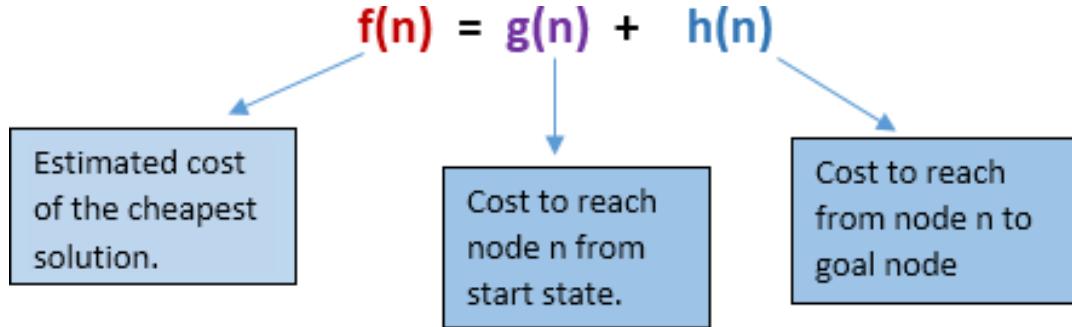
1. **Operating system:** Linux- Ubuntu 16.04 to 17.10, or Windows 7 to 10,
2. **RAM-** 2GB RAM (4GB preferable)
3. You have to install **Python3** or higher version

Theory- A* Search

A* search is the most commonly known form of best-first search. It uses heuristic function $h(n)$, and cost to reach the node n from the start state $g(n)$.

It has combined features of UCS and greedy best- first search, by which it solve the problem efficiently. A* search algorithm finds the shortest path through the search space using the heuristic function. This search algorithm expands less search tree and provides optimal result faster. A* algorithm is similar to UCS except that it uses $g(n)+h(n)$ instead of $g(n)$. In A* search algorithm, we use search heuristic as well as the cost to reach the node.

Hence we can combine both costs as following, and this sum is called as a fitness number.

**Algorithm of A* search:**

Step1: Place the starting node in the OPEN list.

Step 2: Check if the OPEN list is empty or not, if the list is empty then return failure and stops.

Step 3: Select the node from the OPEN list which has the smallest value of evaluation function ($g+h$), if node n is goal node then return success and stop, otherwise

Step 4: Expand node n and generate all of its successors, and put n into the closed list. For each successor n' , check whether n' is already in the OPEN or CLOSED list, if not then compute evaluation function for n' and place into Open list.

Step 5: Else if node n' is already in OPEN and CLOSED, then it should be attached to the back pointer which reflects the lowest $g(n')$ value.

Step 6: Return to Step 2.

Advantages:

1. A* search algorithm is the best algorithm than other search algorithms.
2. A* search algorithm is optimal and complete.
3. This algorithm can solve very complex problems.

Disadvantages:

1. It does not always produce the shortest path as it mostly based on heuristics and approximation.
2. A* search algorithm has some complexity issues.
3. The main drawback of A* is memory requirement as it keeps all generated nodes in the memory, so it is not practical for various large-scale problems.

Conclusion

Implement A* Algorithm for any game search problem in python for searching path.

Assignment No-03

Title: - Implement Greedy search algorithm for Prim's Minimal Spanning Tree Algorithm

Objectives:-

1. Understand the concept of Greedy search algorithm.
2. Understand the implementation of Prim's Minimal Spanning Tree Algorithm

Problem Statement:-

Implement Greedy search algorithm for any of the following application:

- I. Selection Sort
- II. Minimum Spanning Tree
- III. Single-Source Shortest Path Problem
- IV. Job Scheduling Problem
- V. **Prim's Minimal Spanning Tree Algorithm**
- VI. Kruskal's Minimal Spanning Tree Algorithm
- VII. Dijkstra's Minimal Spanning Tree Algorithm

Software and Hardware requirements:-

4. **Operating system:** Linux- Ubuntu 16.04 to 17.10, or Windows 7 to 10,
5. **RAM-** 2GB RAM (4GB preferable)
6. You have to install **Python3** or higher version

Theory-

Minimum Spanning Tree?

. A spanning tree is a subgraph of the undirected connected graph where it includes all the nodes of the graph with the minimum possible number of edges.

In a spanning tree, the edges may or may not have weights associated with them. Therefore, the spanning tree in which the sum of edges is minimum as possible then that spanning tree is called the minimum spanning tree. One graph can have multiple spanning-tree but it can have only one unique minimum spanning tree.

There are two different ways to find out the minimum spanning tree from the complete graph i.e Kruskal's algorithm and Prim's algorithm. Let us study prim's algorithm in detail below:

Prim's Algorithm for Minimum Spanning Tree

Prim's algorithm basically follows the greedy algorithm approach to find the optimal solution. To find the minimum spanning tree using prim's algorithm, we will choose a source node and keep adding the edges with the lowest weight.

The algorithm is as given below:

- Initialize the algorithm by choosing the source vertex
- Find the minimum weight edge connected to the source node and another node and add it to the tree
- Keep repeating this process until we find the minimum spanning tree

Pseudocode

$T = \emptyset;$

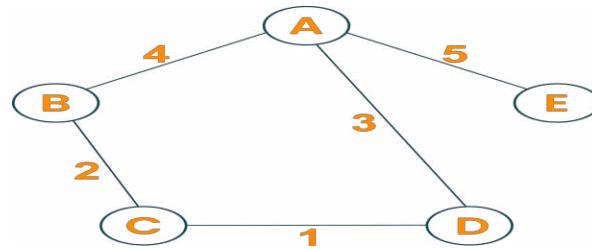
$M = \{ 1 \};$

while ($M \neq N$)

let (m, n) be the lowest cost edge such that $m \in M$ and $n \in N - M$; $T = T \cup \{(m, n)\}$
 $M = M \cup \{n\}$

Here we create two sets of nodes i.e M and $M-N$. M set contains the list of nodes that have been visited and the $M-N$ set contains the nodes that haven't been visited. Later, we will move each node from M to $M-N$ after each step by connecting the least weight edge.

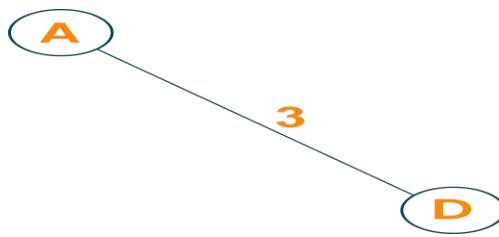
Example Let us consider the below-weighted graph



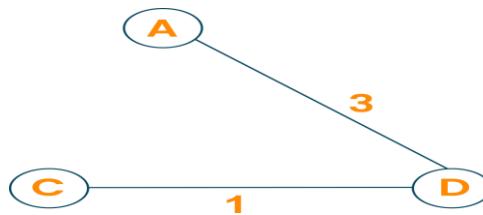
Later we will consider the source vertex to initialize the algorithm



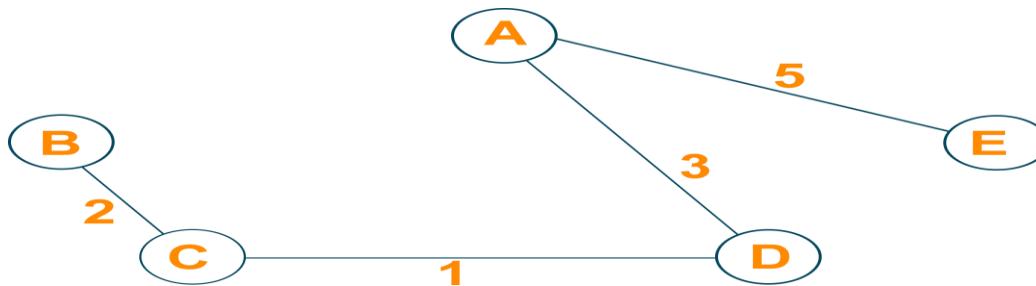
Now, we will choose the shortest weight edge from the source vertex and add it to finding the spanning tree.



Then, choose the next nearest node connected with the minimum edge and add it to the solution. If there are multiple choices then choose anyone.



Continue the steps until all nodes are included and we find the minimum spanning tree.



Time Complexity:

The running time for prim's algorithm is $O(V\log V + E\log V)$ which is equal to $O(E\log V)$ because every insertion of a node in the solution takes logarithmic time. Here, E is the number of edges and V is the number of vertices/nodes. However, we can improve the running time complexity to $O(E + \log V)$ of prim's algorithm using Fibonacci Heaps.

Applications

- Prim's algorithm is used in network design
- It is used in network cycles and rail tracks connecting all the cities
- Prim's algorithm is used in laying cables of electrical wiring

- Prim's algorithm is used in irrigation channels and placing microwave towers
- It is used in cluster analysis
- Prim's algorithm is used in gaming development and cognitive science
- Path finding algorithms in artificial intelligence and traveling salesman problems make use of prim's algorithm.

Conclusion

As we studied, the minimum spanning tree has its own importance in the real world, it is important to learn the prim's algorithm which leads us to find the solution to many problems. When it comes to finding the minimum spanning tree for the dense graphs , prim's algorithm is the first choice.

Assignment No-04

Title: - Implement Branch and Bound and Backtracking for n-queens problem.

Objectives:-

1. Understand the concept and implementation of Branch and Bound for n-queensproblem.
2. Understand the concept and implementation of Backtracking for n-queens problem.

Problem Statement:-

Implement a solution for a Constraint Satisfaction Problem using Branch and Boundand Backtracking for n-queens problem or a graph coloring problem.

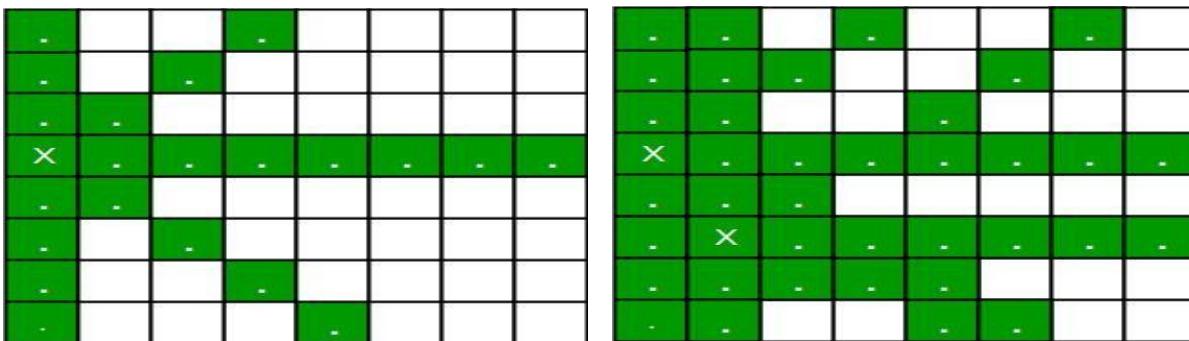
Software and Hardware requirements:-

7. **Operating system:** Linux- Ubuntu 16.04 to 17.10, or Windows 7 to 10,
8. **RAM-** 2GB RAM (4GB preferable)
9. You have to install **Python3** or higher version

Theory-

The **N queens puzzle** is the problem of placing N chess queens on an NxN chessboard so that no two queens threaten each other. Thus, a solution requires that no two queens share the same row, column, or diagonal.

“The idea is to place queens one by one in different columns, starting from the leftmost column. When we place a queen in a column, we check for clashes with already placed queens. In the current column, if we find a row for which there is no clash, we mark this row and column as part of the solution. If we do not find such a row due to clashes, then we backtrack and return false.”



1. For the 1st Queen, there are total 8 possibilities as we can place 1st Queen in any row offirst column. Let's place Queen 1 on row 3.
2. After placing 1st Queen, there are 7 possibilities left for the 2nd Queen. But wait, we don't really have 7 possibilities. We cannot place Queen 2 on rows 2, 3 or 4 as those cells are under attack from Queen 1. So, Queen 2 has only $8 - 3 = 5$ valid positions left.
3. After picking a position for Queen 2, Queen 3 has even fewer options as most of thecells in its column are under attack from the first 2 Queens.

Basically, we have to ensure 4 things:

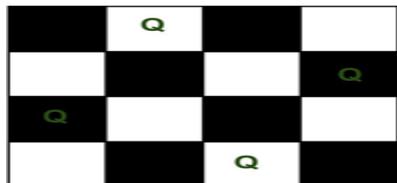
1. No two queens share a column.
2. No two queens share a row.
3. No two queens share a top-right to left-bottom diagonal.
4. No two queens share a top-left to bottom-right diagonal.

Number 1 is automatic because of the way we store the solution. For number 2, 3 and 4, we can perform updates in O(1) time. The idea is to keep **three Boolean arrays that tell us which rows and which diagonals are occupied**.

Backtracking:-

The N Queen is the problem of placing N chess queens on an $N \times N$ chessboard so that no two queens attack each other. For example, following is a solution for 4 Queen problem.

The expected output is a binary matrix which has 1s for the blocks where queens are placed. For example, following is the output matrix for above 4 queen solution.



{ 0, 1, 0, 0}

{ 0, 0, 0, 1}

{ 1, 0, 0, 0}

{ 0, 0, 1, 0}

Backtracking Algorithm

The idea is to place queens one by one in different columns, starting from the leftmost column.

- 1) Start in the leftmost column
- 2) If all queens are placed return true
- 3) Try all rows in the current column.
- 4) Do following for every tried row.
 - a) If the queen can be placed safely in this row then mark this [row, column] as part of the solution and recursively check if placing queen here leads to a solution.
 - b) If placing the queen in [row, column] leads to a solution then return true.
 - c) If placing queen doesn't lead to a solution then unmark this [row, column]

(Backtrack)

- d) and go to step (a) to try other rows.
- 5) If all rows have been tried and nothing worked, return false to trigger backtracking.

Conclusion:- In these way we have implemented a solution for a Constraint SatisfactionProblem using Branch and Bound and Backtracking for n-queens problem.

Assignment No-05

Title: - Develop an elementary chatbot.

Objectives:-

1. Understand the concept of catboat.

Problem Statement:-

Develop an elementary catboat for any suitable customer interaction application.

Software and Hardware requirements:-

10. **Operating system:** Linux- Ubuntu 16.04 to 17.10, or Windows 7 to 10,
11. **RAM-** 2GB RAM (4GB preferable)
12. You have to install **Python3** or higher version or Turbo C++ or JDK.

Theory-

What is a chatbot?

A chatbot is a computer program designed to have a conversation with human beings over the internet. It's also known as conversational agents, which communicate and collaborate with human users, through text messaging, in order to accomplish a specific task. Basically, there are two types of chatbots. The one that uses Artificial Intelligence, and another one is based on multiple choice scripts.

Both types of chatbots aim to create a more personalized content experience for the users, whether that's while watching a video, reading articles or buying new shoes.

Chatbots are capable to interpret human speech, and decide which information is being sought. Artificial intelligence is getting smarter each day, and brands that are

integrating Chatbots with the artificial intelligence, can deliver one-to-one individualized experiences to consumers.

Benefits of chatbot?

1. Available 24*7:

Since chat bots are basically virtual robots they never get tired and continue to obey your command. They will continue to operate every day throughout the year without requiring to take a break. This improves your customer satisfaction and helps you rank highly in your sector.

2. Handling Customers:

No matter what time of the day it is or how many people are contacting you, every single one of them will be answered instantly. Companies like Taco Bell and Domino's are already using chatbots to arrange delivery of parcels.

3. Helps you Save Money:

If you are a business owner you are bound to have a lot of employees who need to be paid for the work they do. And these expenses just keep adding up as business grows. Chatbots are a one time investment which helps businesses reduce down on staff required.

4. Provides 100% satisfaction to customers:

Humans react to others based on their mood and emotions. If an agent is having a good attitude or is in a good mood he will most probably talk to customers in a good way. In contrary to this the customer will not be satisfied.

6. Personal Assistant:

People could use Bots as a fashion advisor for clothing recommendations, or ask trading tips from a finance bot, suggest places to visit from a travel bot and so forth. This would help the users get a more personal touch from the chatbot. Also, the chatbot will remember all your choices and provide you with relevant choices the next time you visit it.

Application across Industries

According to a new survey, 80% of businesses want to integrate chatbots in their business model by 2020. So which industries can reap the greatest benefits by implementing consumer-facing chatbots? According to a chatbot, these major areas of direct-to-consumer engagement are prime:

Chatbots in Hospitality and Travel

For hoteliers, automation has been held up as a solution for all difficulties related to productivity issues, labour costs, a way to ensure consistently, streamlined production processes across the system. Accurate and immediate delivery of information to customers is a major factor in running a successful online Business, especially in the price sensitive and

competitive Travel and Hospitality industry. Chatbots particularly have gotten a lot of attention from the hospitality industry in recent months.

Chatbots in Health Industry

Chatbots are a much better fit for patient engagement than Standalone apps. Through these Health-Bots, users can ask health related questions and receive immediate responses. These responses are either original or based on responses to similar questions in the database. The impersonal nature of a bot could act as a benefit in certain situations, where an actual Doctor is not needed.

Chatbots in E-Commerce

Mobile messengers- connected with Chatbots and the E-commerce business can open a new channel for selling the products online. E-commerce Shopping destination “Spring” was the early adopter. E-commerce future is where brands have their own Chatbots which can interact with their customers through their apps.

Chatbots in Finance

Chatbots have already stepped in Finance Industry. Chatbots can be programmed to assist the customers as Financial Advisor, Expense Saving Bot, Banking Bots, Tax bots, etc. Banks and Fintech have ample opportunities in developing bots for reducing their costs as well as human errors. Chatbots can work for customer's convenience, managing multiple accounts, directly checking their bank balance and expenses on particular things. Further about Finance and Chatbots have been discussed in our earlier blog: Chatbots as your Personal Finance Assistant.

Chatbots in Media

Big publisher or small agency, our suite of tools can help your audience chatbot experience rich and frictionless. Famous News and Media companies like The

Wall StreetJournal, CNN, Fox news, etc have launched their bots to help you receive the latest news on the go.

Conclusion

In this way we implemented an elementary catboat for any suitable customer interaction application.

Assignment No-06

Title: - Implement Expert System.

Objectives:-

Understand the concept of Expert System

Problem Statement:-

Implement any one of the following Expert System

- I. Information management
- II. Hospitals and medical facilities
- III. Help desks management
- IV. Employee performance evaluation
- V. Stock market trading
- VI. Airline scheduling and cargo schedules

Software and Hardware requirements:-

1. Operating system: Linux- Ubuntu 16.04 to 17.10, or Windows 7 to 10,
2. RAM- 2GB RAM (4GB preferable)
3. You have to install Python3 or higher version or Turbo C++ or JDK

Theory-

What is Expert System?

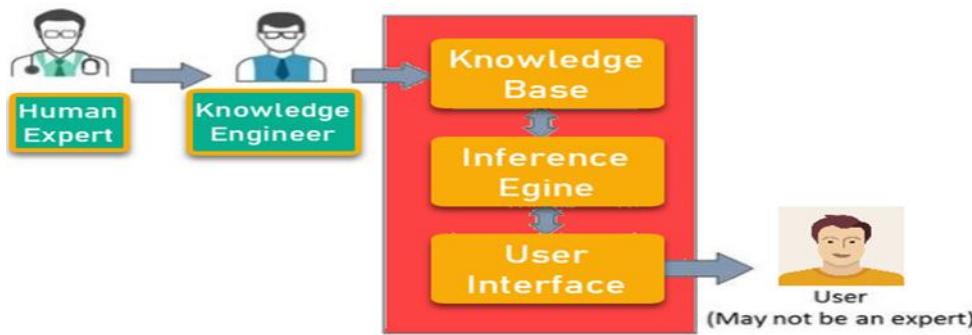
Expert System is an interactive and reliable computer-based decision-making system which uses both facts and heuristics to solve complex decision-making problems. It is considered at the highest level of human intelligence and expertise. The purpose of an expert system is to solve the most complex issues in a specific domain.

Expert Systems in Artificial Intelligence

The Expert System in AI can resolve many issues which generally would require a human expert. It is based on knowledge acquired from an expert. Artificial Intelligence and Expert

Systems are capable of expressing and reasoning about some domain of knowledge. Expert systems were the predecessor of the current day artificial intelligence, deep learning and machine learning systems.

Components of Expert System



The Expert System in AI consists of the following given components:

User Interface

The user interface is the most crucial part of the Expert System Software. This component takes the user's query in a readable form and passes it to the inference engine. After that, it displays the results to the user. In other words, it's an interface that helps the user communicate with the expert system.

Inference Engine

The inference engine is the brain of the expert system. Inference engine contains rules to solve a specific problem. It refers the knowledge from the Knowledge Base. It selects facts and rules to apply when trying to answer the user's query. It provides reasoning about the information in the knowledge base. It also helps in deducting the problem to find the solution. This component is also helpful for formulating conclusions.

Knowledge Base

The knowledge base is a repository of facts. It stores all the knowledge about the problem domain. It is like a large container of knowledge which is obtained from different experts of a specific field.

Knowledge Acquisition

The term knowledge acquisition means how to get required domain knowledge by the expert system. The entire process starts by extracting knowledge from a human expert, converting the acquired knowledge into rules and injecting the developed rules into the knowledge base.

Limitations of Expert System

1. The response of the expert system may get wrong if the knowledge base contains the wrong information.
2. Like a human being, it cannot produce a creative output for different scenarios.
3. Its maintenance and development costs are very high.
4. Knowledge acquisition for designing is much difficult.
5. For each domain, we require a specific ES, which is one of the big limitations.
6. It cannot learn from itself and hence requires manual updates.

Applications of Expert System

1. In designing and manufacturing domain

It can be broadly used for designing and manufacturing physical devices such as camera lenses and automobiles.

2. In the knowledge domain

These systems are primarily used for publishing the relevant knowledge to the users. The two popular ES used for this domain is an advisor and a tax advisor.



Ai LP-II Lab Manual

Computer Engineering (Savitribai Phule Pune University)



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Laboratory Practice II Manual
By- Prof. Kajal Mahale
Artificial Intelligence
Group A

- 1. Implement depth first search algorithm and Breadth First Search algorithm, Use an undirected graph and develop a recursive algorithm for searching all the vertices of a graph or tree data structure.**

BFS is one of the traversing algorithm used in graphs. This algorithm is implemented using a queue data structure. In this algorithm, the main focus is on the vertices of the graph. Select a starting node or vertex at first, mark the starting node or vertex as visited and store it in a queue. Then visit the vertices or nodes which are adjacent to the starting node, mark them as visited and store these vertices or nodes in a queue. Repeat this process until all the nodes or vertices are completely visited.

Advantages of BFS

1. It can be useful in order to find whether the graph has connected components or not.
2. It always finds or returns the shortest path if there is more than one path between two vertices.

Disadvantages of BFS

1. The execution time of this algorithm is very slow because the time complexity of this algorithm is exponential.
2. This algorithm is not useful when large graphs are used.

Explanation:

1. Create a graph.
2. Initialize a starting node.
3. Send the graph and initial node as parameters to the bfs function.

4. Mark the initial node as visited and push it into the queue.
5. Explore the initial node and add its neighbours to the queue and remove the initial node from the queue.
6. Check if the neighbours node of a neighbouring node is already visited.
7. If not, visit the neighbouring node neighbours and mark them as visited.
8. Repeat this process until all the nodes in a graph are visited and the queue becomes empty.

Output:

```
[A', 'B', 'C', 'E', 'D', 'F', 'G']
```

Implementation of BFS in Python (Breadth First Search)

Source Code I: BFS in Python

```
graph = {'A': ['B', 'C', 'E'],
'B': ['A', 'D', 'E'],
'C': ['A', 'F', 'G'],
'D': ['B'],
'E': ['A', 'B', 'D'],
'F': ['C'],
'G': ['C']}
def bfs(graph, initial):
visited = []
queue = [initial]
while queue:
node = queue.pop(0)
if node not in visited:
visited.append(node)
neighbours = graph[node]
```

```
for neighbour in neighbours:  
    queue.append(neighbour)  
return visited  
print(bfs(graph,'A'))
```

Source Code II # BFS algorithm in Python

```
import collections  
  
# BFS algorithm  
  
def bfs(graph, root):  
  
    visited, queue = set(), collections.deque([root])  
    visited.add(root)  
  
    while queue:  
  
        # Dequeue a vertex from queue  
        vertex = queue.popleft()  
        print(str(vertex) + " ", end="")  
  
        # If not visited, mark it as visited, and  
        # enqueue it  
        for neighbour in graph[vertex]:  
            if neighbour not in visited:  
                visited.add(neighbour)  
                queue.append(neighbour)  
  
  
if __name__ == '__main__':  
    graph = {0: [1, 2], 1: [2], 2: [3], 3: [1, 2]}
```

```
print
```

Depth First Search (DFS)

Depth first Search or Depth first traversal is a recursive algorithm for searching all the vertices of a graph or tree data structure. Traversal means visiting all the nodes of a [graph](#).

Depth First Search Algorithm

A standard DFS implementation puts each vertex of the graph into one of two categories:

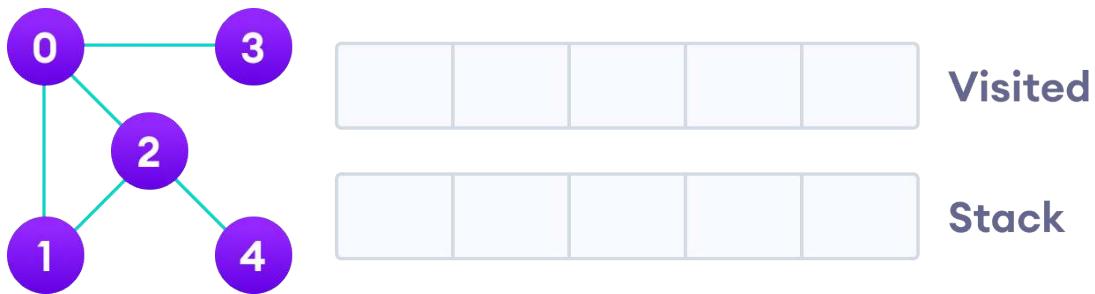
1. Visited
2. Not Visited

The purpose of the algorithm is to mark each vertex as visited while avoiding cycles.

1. Start by putting any one of the graph's vertices on top of a stack.
2. Take the top item of the stack and add it to the visited list.
3. Create a list of that vertex's adjacent nodes. Add the ones which aren't in the visited list to the top of the stack.
4. Keep repeating steps 2 and 3 until the stack is empty.

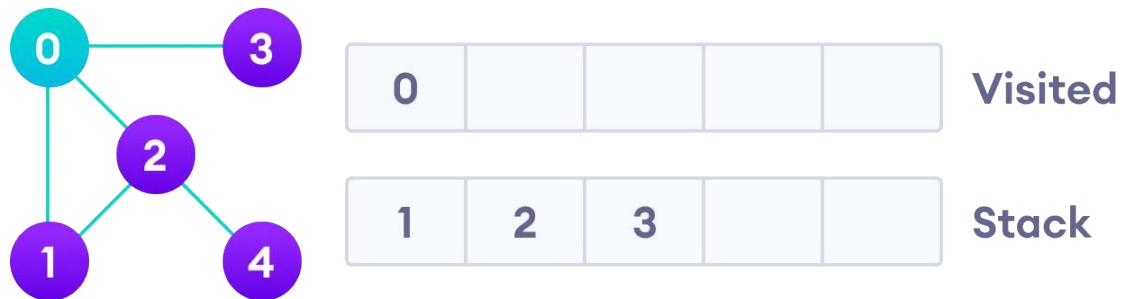
Depth First Search Example

Let's see how the Depth First Search algorithm works with an example. We use an undirected graph with 5 vertices.



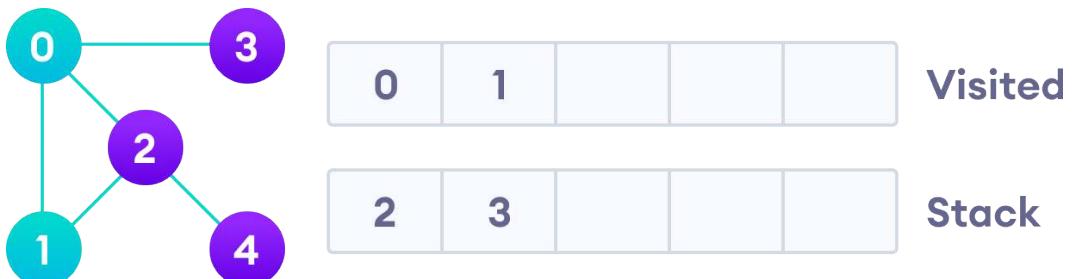
Undirected graph with 5 vertices

We start from vertex 0, the DFS algorithm starts by putting it in the Visited list and putting all its adjacent vertices in the stack.



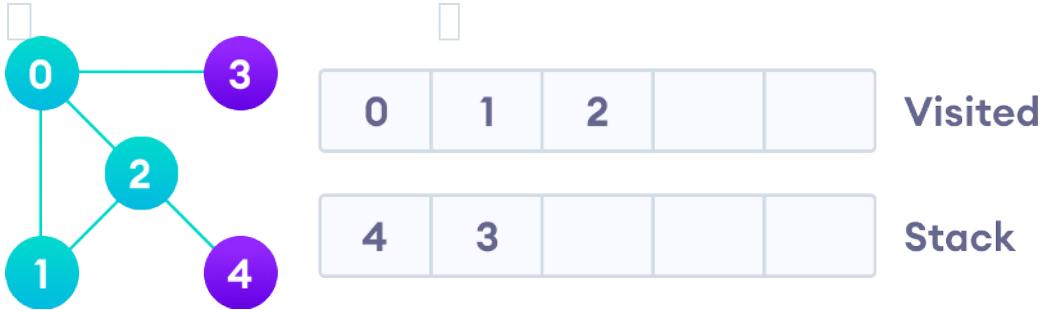
Visit the element and put it in the visited list

Next, we visit the element at the top of stack i.e. 1 and go to its adjacent nodes. Since 0 has already been visited, we visit 2 instead.

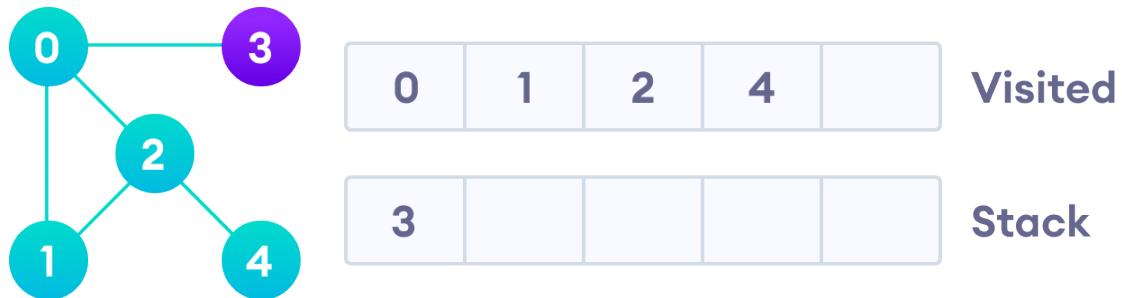


Visit the element at the top of stack

Vertex 2 has an unvisited adjacent vertex in 4, so we add that to the top of the stack and visit it.



Vertex 2 has an unvisited adjacent vertex in 4, so we add that to the top of the stack and visit it.

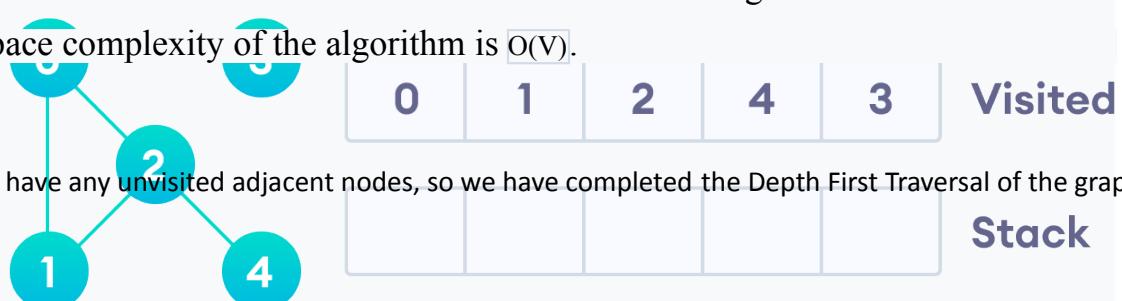


Vertex 2 has an unvisited adjacent vertex in 4, so we add that to the top of the stack and visit it.

The last element 3, it doesn't have any unvisited adjacent nodes, so we have completed the Depth First Traversal.

The time complexity of the DFS algorithm is represented in the form of $O(V + E)$, where V is the number of nodes and E is the number of edges.

The space complexity of the algorithm is $O(V)$.



The last element 3, it doesn't have any unvisited adjacent nodes, so we have completed the Depth First Traversal of the graph.

Application of DFS Algorithm

1. For finding the path
2. To test if the graph is bipartite
3. For finding the strongly connected components of a graph
4. For detecting cycles in a graph

// DFS algorithm in Java

```
import java.util.*;  
  
class Graph {  
    private LinkedList<Integer> adjLists[];  
    private boolean visited[];  
  
    // Graph creation  
    Graph(int vertices) {  
        adjLists = new LinkedList[vertices];  
        visited = new boolean[vertices];  
  
        for (int i = 0; i < vertices; i++)
```

```

adjLists[i] = new LinkedList<Integer>();
}

// Add edges

void addEdge(int src, int dest) {
    adjLists[src].add(dest);
}

// DFS algorithm

void DFS(int vertex) {
    visited[vertex] = true;
    System.out.print(vertex + " ");

    Iterator<Integer> ite = adjLists[vertex].listIterator();
    while (ite.hasNext()) {
        int adj = ite.next();
        if (!visited[adj])
            DFS(adj);
    }
}

public static void main(String args[]) {
    Graph g = new Graph(4);

    g.addEdge(0, 1);
    g.addEdge(0, 2);
    g.addEdge(1, 2);
    g.addEdge(2, 3);

    System.out.println("Following is Depth First Traversal");

    g.DFS(2);
}

```

```
}
```

```
}
```

DFS algorithm in Python

```
# DFS algorithm

def dfs(graph, start, visited=None):
    if visited is None:
        visited = set()
    visited.add(start)

    print(start)
```

```
    for next in graph[start] - visited:
        dfs(graph, next, visited)
    return visited
```

```
graph = {'0': set(['1', '2']),
         '1': set(['0', '3', '4']),
         '2': set(['0']),
         '3': set(['1']),
         '4': set(['2', '3'])}
```

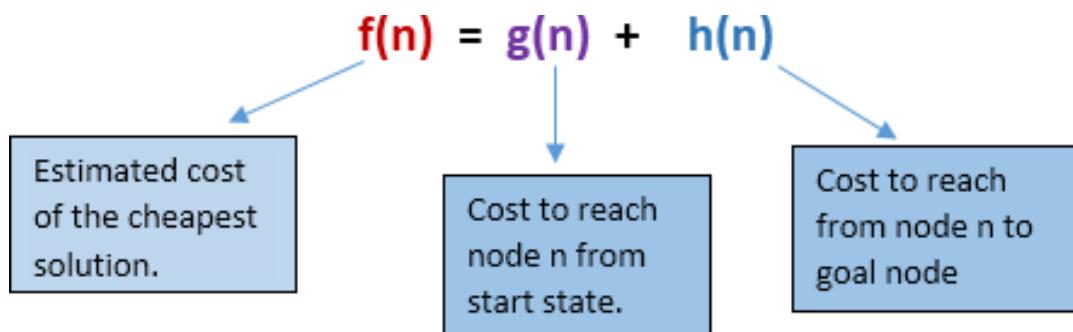
```
dfs(graph, '0')
```

2.Implement A star Algorithm for any game search problem.

A* Search

A* search is the most commonly known form of best-first search. It uses heuristic function $h(n)$, and cost to reach the node n from the start state $g(n)$. It has combined features of UCS and greedy best-first search, by which it solve the problem efficiently. A* search algorithm finds the shortest path through the search space using the heuristic function. This search algorithm expands less search tree and provides optimal result faster. A* algorithm is similar to UCS except that it uses $g(n)+h(n)$ instead of $g(n)$.

In A* search algorithm, we use search heuristic as well as the cost to reach the node. Hence we can combine both costs as following, and this sum is called as a **fitness number**.



Algorithm of A* search:

Step1: Place the starting node in the OPEN list.

Step 2: Check if the OPEN list is empty or not, if the list is empty then return failure and stops.

Step 3: Select the node from the OPEN list which has the smallest value of evaluation function ($g+h$), if node n is goal node then return success and stop, otherwise

Step 4: Expand node n and generate all of its successors, and put n into the closed list. For each successor n' , check whether n' is already in the OPEN or CLOSED list, if not then compute evaluation function for n' and place into Open list.

Step 5: Else if node n' is already in OPEN and CLOSED, then it should be attached to the back pointer which reflects the lowest $g(n')$ value.

Step 6: Return to Step 2.

Advantages:

1. A* search algorithm is the best algorithm than other search algorithms.
2. A* search algorithm is optimal and complete.
3. This algorithm can solve very complex problems.

Disadvantages:

1. It does not always produce the shortest path as it mostly based on heuristics and approximation.
2. A* search algorithm has some complexity issues.
3. The main drawback of A* is memory requirement as it keeps all generated nodes in the memory, so it is not practical for various large-scale problems.

#AIM: Implement A* search.

```
dict_hn={'Arad':336,'Bucharest':0,'Craiova':160,'Drobeta':242,'Eforie':161,
'Fagaras':176,'Giurgiu':77,'Hirsova':151,'Iasi':226,'Lugoj':244,
'Mehadia':241,'Neamt':234,'Oradea':380,'Pitesti':100,'Rimnicu':193,
'Sibiu':253,'Timisoara':329,'Urziceni':80,'Vaslui':199,'Zerind':374}
```

```
dict_gn=dict( Arad=dict(Zerind=75,Timisoara=11
8,Sibiu=140),
Bucharest=dict(Urziceni=85,Giurgiu=90,Pitesti=101,Fagaras=211),
Craiova=dict(Drobeta=120,Pitesti=138,Rimnicu=146),
Drobeta=dict(Mehadia=75,Craiova=120),
Eforie=dict(Hirsova=86),
Fagaras=dict(Sibiu=99,Bucharest=211),
Giurgiu=dict(Bucharest=90),
```

```

Hirsova=dict(Eforie=86,Urziceni=98),
Iasi=dict(Neamt=87,Vaslui=92),
Lugoj=dict(Mehadia=70,Timisoara=111),
Mehadia=dict(Lugoj=70,Drobeta=75),
Neamt=dict(Iasi=87),
Oradea=dict(Zerind=71,Sibiu=151),
Pitesti=dict(Rimnicu=97,Bucharest=101,Craiova=138),
Rimnicu=dict(Sibiu=80,Pitesti=97,Craiova=146),
Sibiu=dict(Rimnicu=80,Fagaras=99,Arad=140,Oradea=151),
Timisoara=dict(Lugoj=111,Arad=118),
Urziceni=dict(Bucharest=85,Hirsova=98,Vaslui=142),
Vaslui=dict(Iasi=92,Urziceni=142),
Zerind=dict(Oradea=71,Arad=75)
)

```

```

import queue as Q
#from RMP import dict_gn
#from RMP import dict_hn

```

```
start='Arad'
```

```
goal='Bucharest'
```

```
result=""
```

```

def get_fn(citystr):
    cities=citystr.split(" , ")
    hn=gn=0
    for ctr in range(0, len(cities)-1):
        gn=gn+dict_gn[cities[ctr]][cities[ctr+1]]
    hn=dict_hn[cities[len(cities)-1]]
    return(hn+gn)

```

```
def expand(cityq):
```

```
    global result
```

```

tot, citystr, thiscity=cityq.get()
if thiscity==goal:
    result=citystr+" : : "+str(tot)
    return
for cty in dict_gn[thiscity]:
    cityq.put((get_fn(citystr+" , "+cty), citystr+" , "+cty, cty))
expand(cityq)

def main():
    cityq=Q.PriorityQueue()
    thiscity=start
    cityq.put((get_fn(start),start,thiscity))
    expand(cityq)
    print("The A* path with the total is: ")
    print(result)

main()

```

OUTPUT:

The A* path with the total is:

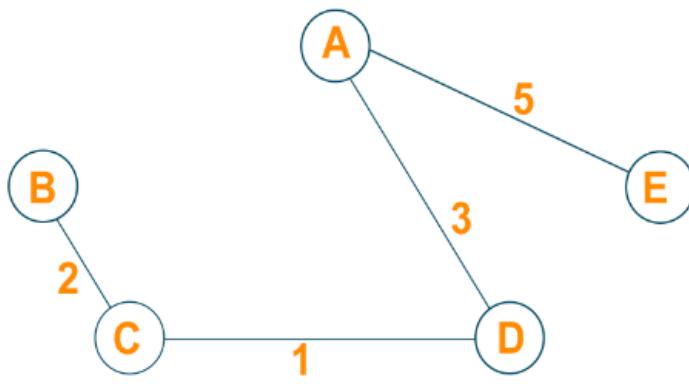
Arad , Sibiu , Rimnicu , Pitesti , Bucharest : : 418

3. Implement Greedy search algorithm for any of the following application: Prim's Minimal Spanning Tree Algorithm

Prim's Algorithm | Minimum Spanning Tree (Python Code)



Prim's Algorithm (Minimum Spanning Tree)



We will study what is the minimum spanning tree and how to convert a graph into a minimum spanning tree using Prim's Algorithm. We will learn the algorithm and python code for prim's algorithm and an example for better understanding. Lastly, we will study the running time complexity and applications of prim's algorithm in real life.

What is a Minimum Spanning Tree?

As we all know, the graph which does not have edges pointing to any direction in a graph is called an undirected graph and the graph always has a path from a vertex to any other vertex. A spanning tree is a subgraph of the undirected connected graph where it includes all the nodes of the graph with the minimum possible number of edges. Remember, the subgraph should contain each and every node of the original graph. If any node is missed out then it is not a spanning tree and also, the spanning tree doesn't contain cycles. If the graph has n number of nodes, then the total number of spanning trees created from a complete graph is equal to n^{n-2} . In a spanning tree, the edges may or may not have weights associated with them. Therefore, the spanning tree in which the sum of edges is minimum as possible then that spanning tree is called the minimum spanning tree. One graph can have multiple spanning-tree but it can have only one unique minimum spanning tree. There are two different ways to find out the minimum spanning tree from the complete graph i.e [Kruskal's algorithm](#) and Prim's algorithm. Let us study prim's algorithm in detail below:

What is Prim's Algorithm?

Prim's algorithm is a minimum spanning tree algorithm which helps to find out the edges of the graph to form the tree including every node with the minimum sum of weights to form the minimum spanning tree. Prim's algorithm starts with the single source node and later explores all the adjacent nodes of the source node with all the connecting edges. While we are exploring the graphs, we will choose the edges with the minimum weight and those which cannot cause the cycles in the graph.

Prim's Algorithm for Minimum Spanning Tree

Prim's algorithm basically follows the greedy algorithm approach to find the optimal solution. To find the minimum spanning tree using prim's algorithm, we will choose a source node and keep adding the edges with the lowest weight.

The algorithm is as given below:

- Initialize the algorithm by choosing the source vertex
- Find the minimum weight edge connected to the source node and another node and add it to the tree
- Keep repeating this process until we find the minimum spanning tree

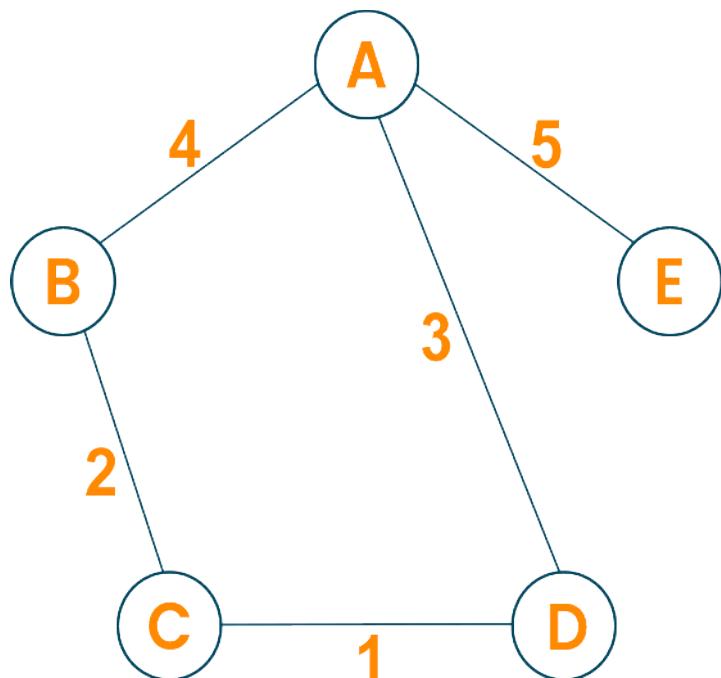
Pseudocode

```
T =  $\emptyset$ ;  
M = { 1 };  
while (M  $\neq$  N)  
    let (m, n) be the lowest cost edge such that m  $\in$  M and n  $\in$  N -  
    M; T = T  $\cup$  {(m, n)}  
    M = M  $\cup$  {n}
```

Here we create two sets of nodes i.e M and M-N. M set contains the list of nodes that have been visited and the M-N set contains the nodes that haven't been visited. Later, we will move each node from M to M-N after each step by connecting the least weight edge.

Example

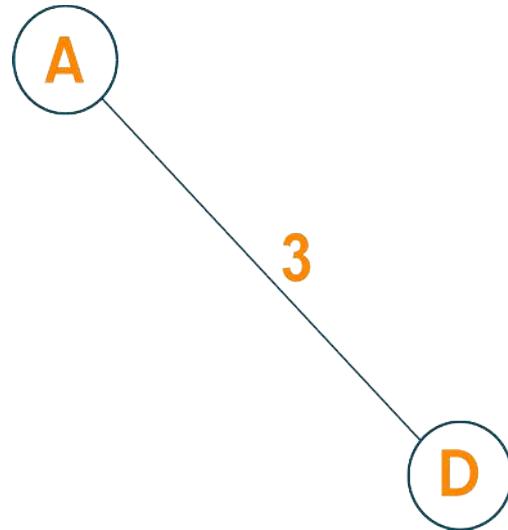
Let us consider the below-weighted graph



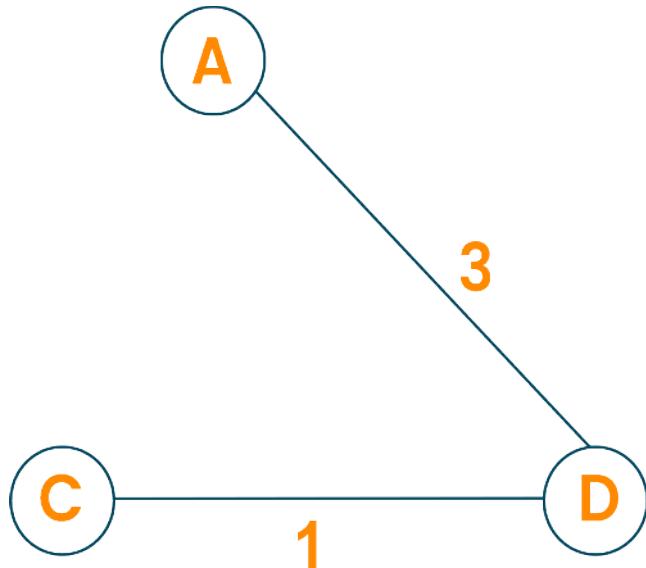
Later we will consider the source vertex to initialize the algorithm



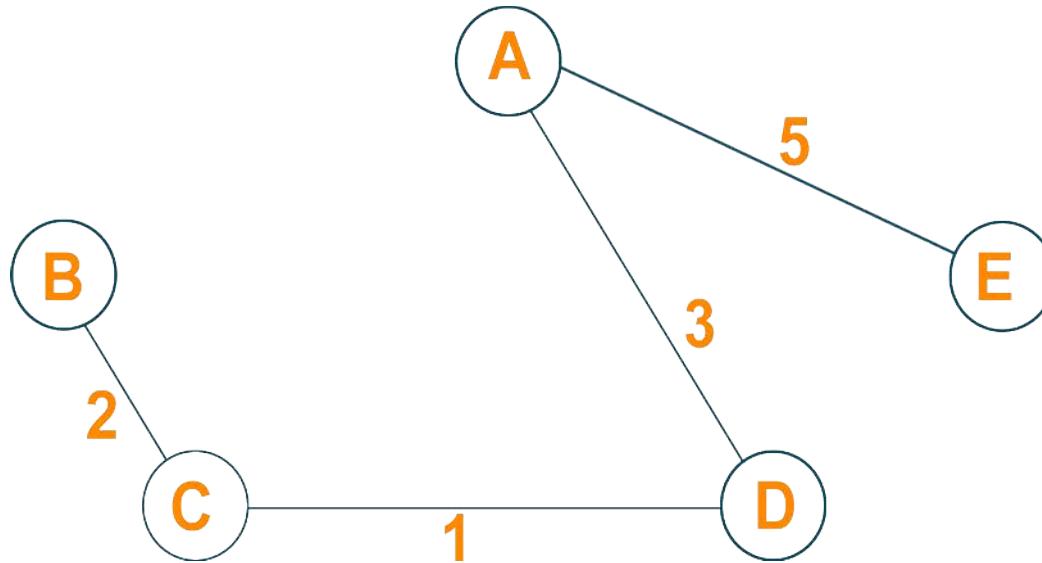
Now, we will choose the shortest weight edge from the source vertex and add it to finding the spanning tree.



Then, choose the next nearest node connected with the minimum edge and add it to the solution. If there are multiple choices then choose anyone.



Continue the steps until all nodes are included and we find the minimum spanning tree.



```
# Prim's Algorithm in Python
```

```

INF = 9999999
# number of vertices in graph
N = 5
#creating graph by adjacency matrix method
G = [[0, 19, 5, 0, 0],
      [19, 0, 5, 9, 2],
      [5, 5, 0, 1, 6],
      [0, 9, 1, 0, 1],
      [0, 2, 6, 1, 0]]

selected_node = [0, 0, 0, 0, 0]
no_edge = 0
selected_node[0] = True

# printing for edge and weight
print("Edge : Weight\n")
while (no_edge < N - 1):

    minimum = INF
    a = 0
    b = 0
    for m in range(N):
        if selected_node[m]:
            for n in range(N):
                if ((not selected_node[n]) and G[m][n]):
                    # not in selected and there is an edge
                    if minimum > G[m][n]:
                        minimum = G[m][n]
                        a = m
                        b = n
    print(a, " -> ", b, " : ", G[a][b])
    selected_node[b] = True
    no_edge += 1

```

```

a = m
b = n
print(str(a) + "-" + str(b) + ":" + str(G[a][b]))
selected_node[b] = True
no_edge += 1

```

Time Complexity:

The running time for prim's algorithm is $O(V\log V + E\log V)$ which is equal to $O(E\log V)$ because every insertion of a node in the solution takes logarithmic time. Here, E is the number of edges and V is the number of vertices/nodes. However, we can improve the running time complexity to $O(E + \log V)$ of prim's algorithm using Fibonacci Heaps.

Applications

- Prim's algorithm is used in network design
- It is used in network cycles and rail tracks connecting all the cities
- Prim's algorithm is used in laying cables of electrical wiring
- Prim's algorithm is used in irrigation channels and placing microwave towers
- It is used in cluster analysis
- Prim's algorithm is used in gaming development and cognitive science
- Pathfinding algorithms in artificial intelligence and traveling salesman problems make use of prim's algorithm.

Conclusion

As we studied, the minimum spanning tree has its own importance in the real world, it is important to learn the prim's algorithm which leads us to find the solution to many problems. When it comes to finding the minimum spanning tree for the dense graphs, prim's algorithm is the first choice.

Group-B

4. Implement a solution for a Constraint Satisfaction Problem using Branch and Bound and Backtracking for n-queens problem or a graph coloring problem

8 Queens Problem using Branch and Bound

The N-Queens problem is a puzzle of placing exactly N queens on an $N \times N$ chessboard, such that no two queens can attack each other in that configuration. Thus, no two queens can lie in the same row, column or diagonal.

The branch and bound solution is somehow different, it generates a partial solution until it figures that there's no point going deeper as we would ultimately lead to a dead end.

In the backtracking approach, we maintain an 8x8 binary matrix for keeping track of safe cells (by eliminating the unsafe cells, those that are likely to be attacked) and update it each time we place a new queen. However, it required $O(n^2)$ time to check safe cell and update the queen.

In the 8 queens problem, we ensure the following:

1. no two queens share a row
2. no two queens share a column
3. no two queens share the same left diagonal
4. no two queens share the same right diagonal

We already ensure that the queens do not share the same column by the way we fill out our auxiliary matrix (column by column). Hence, only the left out 3 conditions are left out to be satisfied.

Applying the branch and bound approach :

The branch and bound approach suggests that we create a partial solution and use it to ascertain whether we need to continue in a particular direction or not. For this problem, we create 3 arrays to check for conditions 1, 3 and 4. The boolean arrays tell which rows and diagonals are already occupied. To achieve this, we need a numbering system to specify which queen is placed.

The indexes on these arrays would help us know which queen we are analysing.

Preprocessing - create two NxN matrices, one for top-left to bottom-right diagonal, and other for top-right to bottom-left diagonal. We need to fill these in such a way that two queens sharing same top-left_bottom-right diagonal will have same value in slashDiagonal and two queens sharing same top-right_bottom-left diagonal will have same value in backSlashDiagnol.

$\text{slashDiagnol}(\text{row})(\text{col}) = \text{row} + \text{col}$
 $\text{backSlashDiagnol}(\text{row})(\text{col}) = \text{row} - \text{col} + (\text{N}-1)$ { $\text{N} = 8$ }
 { we added $(\text{N}-1)$ as we do not need negative values in backSlashDiagnol }

7	6	5	4	3	2	1	0
8	7	6	5	4	3	2	1
9	8	7	6	5	4	3	2
10	9	8	7	6	5	4	3
11	10	9	8	7	6	5	4
12	11	10	9	8	7	6	5
13	12	11	10	9	8	7	6
14	13	12	11	10	9	8	7

slash diagnol[row][col] = row + col

0	1	2	3	4	5	6	7
1	2	3	4	5	6	7	8
2	3	4	5	6	7	8	9
3	4	5	6	7	8	9	10
4	5	6	7	8	9	10	11
5	6	7	8	9	10	11	12
6	7	8	9	10	11	12	13
7	8	9	10	11	12	13	14

backslash diagnol[row][col] = row-col+(N-1)

For placing a queen i on row j , check the following :

1. whether row ' j ' is used or not
2. whether slashDiagnol ' $i+j$ ' is used or not
3. whether backSlashDiagnol ' $i-j+7$ ' is used or not

If the answer to any one of the following is true, we try another location for queen **i** on row **j**, mark the row and diagonals; and recur for queen **i+1**.

```

#include<bits/stdc+
+.h> using namespace
std; int board[8][8]
int n
// function to print solution
void printSolution(int board[n][n])
{
  for (int i = 0; i < n; i++)
  {
    for (int j = 0; j < n; j++)
  
```

```

    { cout<<board[i][j]<<" ";
    }
    cout<<endl;
}

}

//function to check if queen can
// be placed on board[row][col]

bool isPossible(int row, int col, int slashDiagnol[n][n],
               int backSlashDiagnol[n][n], bool rowLook[n],
               bool slashDiagnolLook[], bool backSlashDiagnolLook[])
{
    if (slashDiagnolLook(slashDiagnol[row][col] || backSlashDiagnol[row][col]
        || rowLook[row] )
        return false;

    return true;
}

//A recursive utility function to solve N Queen problem

bool solveNQueensUtil(int board[n][n], int col,
                      int slashDiagnol[n][n],int backSlashDiagnol[n][n],
                      bool rowLook[n], bool slashDiagnolLook[],
                      bool backSlashDiagnolLook[] )
{
    //base case: If all queens are placed
    if (col >= N)
        return true;
}

```

```

//Consider this column and try placing
// queen in all rows one by one
for (int i = 0; i < n; i++)
{
    if ( isPossible(i, col, slashDiagnol, backSlashDiagnol,
                    rowLook, slashDiagnolLook,
                    backSlashDiagnolLook) )
    {
        board[i][col] = 1;
        rowLookup[i] = true;
        slashDiagnolLook[slashDiagnol[i][col]] = true;
        backSlashDiagnolLook[backSlashDiagnol[i][col]] = true;

        //recur to place rest of the queens
        if ( solveNQueensUtil(board, col + 1, slashCode, backslashCode,
                              rowLookup, slashCodeLookup, backslashCodeLookup) )
            return true;

        // placing queen in board[i][col]
        // dosen't yield a solution, backtrack

        board[i][col] = 0;
        rowLook[i] = false;
        slashDiagolLook[slashDiagnol[i][col]] = false;
        backSlashDiagnolLook[backSlashDiagnol[i][col]] = false;
    }
}

//If queen can not be place in any row in

```

```

//this colum col then return false
return false;
}

/* This function solves the N Queen problem using Branch and Bound. It mainly uses
solveNQueensUtil() to solve the problem. It returns false if queens cannot be placed,
otherwise return true and prints placement of queens in the form of 1s. Please note that
there may be more than one solutions, this function prints one of the feasible solutions.*/
bool solveNQueens(n)
{
    memset(board, 0, sizeof(board));

    // helper matrices
    int slashDiagnol[n][n];
    int backSlashDiagnol[n][n];

    // arrays to tell us which rows are occupied
    bool rowLook[n] = {false};

    //keep two arrays to tell us which diagonals are occupied
    bool slashDiagnolLook[2*n-1] = {false};
    bool backSlashDiagnolLook[2*n-1] = {false};

    // initialize helper matrices
    for (int r = 0; r < n; r++)
        for (int c = 0; c < n; c++)
    {
        slashDiagnol[r][c] = r+c;
        backSlashDiagnol[r][c] = (r+c-7);
    }
}

```

```

if (solveNQueensUtil(board, 0, slashDiagnol, backSlashDiagnol,
    rowLook, slashDiagnolLook, backSlashDiagnolLook) == false)
{
    cout<<"No solution"<<endl;
    return false;
}

// solution found
printSolution(board);
return true;
}

// main function
int main()
{
    cin>>n; // can take any size from 0 to 8
    solveNQueens(n);
    return 0;
}

Output-
for (n = 8)

1 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0
0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 1
0 1 0 0 0 0 0 0
0 0 0 1 0 0 0 0
0 0 0 0 0 1 0 0
0 0 1 0 0 0 0 0

```

Graph coloring problem's solution using backtracking algorithm

Graph coloring

The **graph coloring problem** is to discover whether the nodes of the graph G can be covered in such a way, that no two adjacent nodes have the same color yet only m colors are used. This graph coloring problem is also known as M-colorability decision problem.

The M – colorability optimization problem deals with the smallest integer m for which the graph G can be colored. The integer is known as a chromatic number of the graph.

Here, it can also be noticed that if d is the degree of the given graph, then it can be colored with $d+1$ color.

A graph is also known to be planar if and only if it can be drawn in a planar in such a way that no two edges cross each other. A special case is the 4 - colors problem for planar graphs. The problem is to color the region in a map in such a way that no two adjacent regions have the same color. Yet only four colors are needed. This is a problem for which graphs are very useful because a map can be easily transformed into a graph. Each region of the map becomes the node, and if two regions are adjacent, they are joined by an edge.

Graph coloring problem can also be solved using a state space tree, whereby applying a backtracking method required results are obtained.

For solving the **graph coloring problem**, we suppose that the graph is represented by its adjacency matrix $G[1:n, 1:n]$, where, $G[i, j] = 1$ if (i, j) is an edge of G , and $G[i, j] = 0$ otherwise.

The colors are represented by the integers $1, 2, \dots, m$ and the solutions are given by the n-tuple $(x_1, x_2, x_3, \dots, x_n)$, where x_1 is the color of node i .

Algorithm for finding the m - colorings of a graph

1. Algorithm mcoloring (k)
2. // this algorithm is formed using the recursive backtracking
3. // schema. The graph is represented by its Boolean adjacency
4. // matrix G [1: n, 1: n]. All assignments of 1, 2, ..., m to the
5. // vertices of the graph such that adjacent vertices are
6. // assigned distinct are printed. K is the index
7. // of the next vertex to color.

```

{ 8.
Repeat
{ 10.
// generate all legal assignments for x[k], Next value (k); // assign to x[k] a legal color.
If (x[1:k] = 0 ) then return; // no new color possible
If (k < n) then // at most m colors have been used to color the n
14.    vertices.
        Write (x[1 : n ]);
        Else mcoloring (k + 1);
    17.}
    18.Until (false);
    19.}

```

This algorithm uses the recursive backtracking schema. In this algorithm colors to be assigned are to determine from the range $(0, m)$, i.e., m colors are available.

The total time required by the above algorithm is $O(nm^n)$.

Implementation of Backtracking solution

C/C++

```

/* C/C++ program to solve N Queen Problem using
backtracking */
#define N 4
#include <stdbool.h>
#include <stdio.h>

/* A utility function to print solution */
void printSolution(int board[N][N])
{
    for (int i = 0; i < N; i++) {
        for (int j = 0; j < N; j++)
            printf(" %d ", board[i][j]);
        printf("\n");
    }
}

```

```
/* A utility function to check if a queen canbe placed on board[row][col]. Note  
that this function is called when "col" queens arealready placed in columns from  
0 to col -1. So we need to check only left side for attacking queens */
```

```
bool isSafe(int board[N][N], int row, int col)  
{  
    int i, j;  
  
    /* Check this row on left side */  
    for (i = 0; i < col; i++)  
        if (board[row][i])  
            return false;  
  
    /* Check upper diagonal on left side */  
    for (i = row, j = col; i >= 0 && j >= 0; i--, j--)  
        if (board[i][j])  
            return false;  
  
    /* Check lower diagonal on left side */  
    for (i = row, j = col; j >= 0 && i < N; i++, j--)  
        if (board[i][j])  
            return false;  
  
    return true;  
}
```

```
/* A recursive utility function to solve N  
Queen problem */  
bool solveNQUtil(int board[N][N], int col)  
{  
    /* base case: If all queens are placed  
       then return true */  
    if (col >= N)  
        return true;  
  
    /* Consider this column and try placing  
       this queen in all rows one by one */  
    for (int i = 0; i < N; i++) {  
        /* Check if the queen can be placed on  
           board[i][col] */  
        if (isSafe(board, i, col)) {  
            /* Place this queen in board[i][col] */  
            board[i][col] = 1;
```

```

/* recur to place rest of the queens */
if (solveNQUtil(board, col + 1))
    return true;

/* If placing queen in board[i][col]
   doesn't lead to a solution, then
   remove queen from board[i][col] */
board[i][col] = 0; // BACKTRACK
}
}

/* If the queen cannot be placed in any row in
   this column col then return false */
return false;
}

/* This function solves the N Queen problem using Backtracking. It mainly
   uses solveNQUtil() to solve the problem. It returns false if queens cannot be
   placed, otherwise, return true and prints placement of queens in the form of 1s.
   Please note that there may be more than one solutions, this function prints one
   of the feasible solutions.*/
bool solveNQ()
{
    int board[N][N] = { { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 } };

    if (solveNQUtil(board, 0) == false) {
        printf("Solution does not exist");
        return false;
    }

    printSolution(board);
    return true;
}

// driver program to test above function
int main()
{
    solveNQ();
    return 0;
}

```

}

Output:The 1 values indicate placements of queens

```
0 0 1 0  
1 0 0 0  
0 0 0 1  
0 1 0 0
```

5. Develop an elementary chatbot for any suitable customer interaction application.

What is a chatbot?

A chatbot is a computer program designed to have a conversation with human beings over the internet. It's also known as conversational agents, which communicate and collaborate with human users, through text messaging, in order to accomplish a specific task. Basically, there are two types of chatbots. The one that uses **Artificial Intelligence**, and another one is based on multiple choice scripts.

Both types of chatbots aim to create a more personalized content experience for the users, whether that's while watching a video, reading articles or buying new shoes.

These Chatbots hold the promise of being the next generation of technology that people use to interact online with business enterprises. These Chatbots offer a lot of advantages, one of which is that, because Chatbots communicate using a natural language, users don't need to learn yet another new website interface, to get comfortable with the unavoidable quirks.

Chatbots are capable to interpret human speech, and decide which information is being sought. Artificial intelligence is getting smarter each day, and brands that are integrating Chatbots with the artificial intelligence, can deliver one-to-one individualized experiences to consumers.

Why chatbot?

Chatbots can be useful in many aspects of the customer experience, including providing customer service, presenting product recommendations and engaging customers through targeted marketing campaigns. If a customer has an issue with a

product, she can connect with a chatbot to explain the situation and the chatbot can input that information to provide a recommendation of how to fix the product. On the recommendation side, chatbots can be used to share popular products with customers that they might find useful and can act as a sort of personal shopper or concierge service to find the perfect gift, meal or night out for a customer with just a few basic questions. Brands are also using chatbots to connect their customers with thought leaders and add personality to their products. In all cases, brands seem to be having great success and experiencing increased engagement and revenue.

Chatbots are easy to use and many customers prefer them over calling a representative on the phone because it tends to be faster and less invasive. They can also save money for companies and are easy to set up.

Chatbots are relatively new and most companies haven't implemented them yet, it's only natural that users are interested in them. Hence, people want to discover what chatbots can and cannot do.

The number of businesses using chatbots has grown exponentially. Chatbots have increased from 30,000 in 2016 to over 100,000 today. Every major company has announced their own chatbot and 60% of the youth population uses them daily.

These statistics prove that chatbots are the new-gen tech. No more waiting for the right time to incorporate them into your business. The time is now. By the year 2020, nearly 80% of businesses will have their own chatbot.

Billions of people are already using chatbots, so it's time your business did too.

Benefits of chatbot?

Chatbots are being made to ease the pain that the industries are facing today. The purpose of chat bots is to support and scale business teams in their relations with customers.

Chatbots may sound like a futuristic notion, but according to Global Web Index statistics, it is said that 75% of internet users are adopting one or more messenger platforms. Although research shows us that each user makes use of an average of 24 apps a month, wherein 80% of the time would be in just 5 apps. This means you can hardly shoot ahead with an app, but you still have high chances to integrate your chatbot with one of these platforms.

Now lets go through some of the benefits that chatbots provide:

1. Available 24*7:

I'm sure most of you have experienced listening to the boring music playing while you're kept on hold by a customer care agent. On an average people spend 7 minutes

until they are assigned to an agent. Gone are the days of waiting for the next available operative. Bots are replacing live chat and other forms of contact such as emails and phone calls.

Since chat bots are basically virtual robots they never get tired and continue to obey your command. They will continue to operate every day throughout the year without requiring to take a break. This improves your customer satisfaction and helps you rank highly in your sector.

2. Handling Customers:

We humans are restricted to the number of things we can do at the same time. A study suggests that humans can only concentrate on 3–4 things at the same time. If it goes beyond that you are bound to meet errors.

Chatbots on the other hand can simultaneously have conversations with thousands of people. No matter what time of the day it is or how many people are contacting you, every single one of them will be answered instantly. Companies like Taco Bell and Domino's are already using chatbots to arrange delivery of parcels.

3. Helps you Save Money:

If you are a business owner you are bound have a lot of employees who need to be paid for the work they do. And these expenses just keep adding up as business grows. Chatbots are a one time investment which helps businesses reduce down on staff required.

You could integrate a customer support chatbot in your business to cater to simple queries of customers and pass on only the complex queries to customer support agents.

4. Provides 100% satisfaction to customers:

Humans react to others based on their mood and emotions. If a agent is having a good attitude or is in good mood he will most probably talk to customers in a good way. In contrary to this the customer will not be satisfied.

Whereas chatbots are bound by some rules and obey them as long as they're programmed to. They always treat a customer in the most polite and perfect way no matter how rough the person is. Also, in the travel and hospitality industry where travelers do not speak the same language, a bot can be trained to communicate in the language of the traveler.

5. Automation of repetitive work:

Lets be honest, no one likes doing the same work again and again over brief period of time. In the case of humans, such tasks are prone to errors. Chatbots now help automate tasks which are to be done frequently and at the right time.

Also, now there are numerous slack bots which automate repetitive tasks. This helps people save time and increase productivity. For example, there are new items bought from your eCommerce site or there is a bug reported then it sends a short summary to a slack channel.

6. Personal Assistant:

People could use Bots as a fashion advisor for clothing recommendations, or ask trading tips from a finance bot, suggest places to visit from a travel bot and so forth. This would help the users get a more personal touch from the chatbot. Also, the chatbot will remember all your choices and provide you with relevant choices the next time you visit it.

How chatbot can drive revenue for you?

Below we have compiled reasons why chatbots are important for your business and how can they help in increasing revenues:

a. Higher user customer engagement

Most businesses these days have a web presence. But with being on the internet, boundaries of day and night, availability and unavailability have changed, so have user expectations. This is probably the biggest reason to use them. Bots give the user an interactive experience. It makes customers feel they are working with someone to help resolve their issue. If done right, bots can help customers find what they are looking for and make them more likely to return.

Customer Engagement

- Clearance Sale : Notify users about on-going clearance sale of products relevant to the users at their nearest outlets.
- Product Finder : Enable consultative selling without the need of a call center
- Offer Notification : Notify users about offers, product launches on products/ services they've shown interest in, and products that's back in stock

b. Mobile-ready and immediate availability

Along with a web presence, it has also become increasingly important for brands to have a mobile presence - mobile apps, mobile-optimized websites. Considering how chat has been around on the mobile for ages, most chatbot

implementations don't need you to work on tweaking their UI, they are ready to implement and so available to your customers immediately

You might argue that you have an app for that. Having an app for your brand is great, but having users discover that app, download it and use it to stay engaged is not an easy deal. Instead, implementing a chatbot - which works on the mobile browser or a messaging-app which the user regularly uses - makes it all the more reason for a customer to be engaged with the brand

c. It can drive sales

Chatbots can be intelligent. Depending on a user's preferences or purchases, it can send products to customers which are more likely to convert into sales. Or it can send coupons to users for in-store purchases/discounts. Bots can also be used to link the user to your mCommerce site/app so they can buy the product directly from the convenience of their phones

Sell Intelligently

- Product Recommendations : Push proactive recommendations to users based on their preferences and search and order history.
- Enable order booking over chat.

d. Minimal cost - Maximum return

The best part about bots is they are cheap. Chatbot provide the necessary infrastructure and APIs for creating these bots. They require minimal maintenance and since it is automated, there is no labor-intensive work that goes in there.

e. Customer Service

- Track Order : Keep users up to date with order status. Schedule or reschedule delivery to a provided address or request to pick it up at any other Best Buy outlet.
- Stock outs : Notify users when desired product is available and place order over a chat.
- Returns and Replacements : No waiting time to reach customer care. Customers can instantly place request to replace or return an order.
- Seek Reviews : Reach out to users to seek reviews on the products recently bought

Gift Recommendations

- Recommend relevant gifting options to users, accessing calendar events and understanding the likes and style of beneficiary.
- Opportunity to upsell gift cards for the users for every occasion.

Application across Industries



According to a new survey, 80% of businesses want to integrate chatbots in their business model by 2020. So which industries can reap the greatest benefits by implementing consumer-facing chatbots? According to a chatbot, these major areas of direct-to-consumer engagement are prime:

Chatbots in Restaurant and Retail Industries

Famous restaurant chains like Burger King and Taco bell has introduced their Chatbots to stand out of competitors of the Industry as well as treat their customers quickly. Customers of these restaurants are greeted by the resident Chatbots, and are offered the menu options- like a counter order, the Buyer chooses their pickup location, pays, and gets told when they can head over to grab their food. Chatbots also works to accept table reservations, take special requests and go take the extra step to make the evening special for your guests.

Chatbots are not only good for the restaurant staff in reducing work and pain but can provide a better user experience for the customers.

Chatbots in Hospitality and Travel

For hoteliers, automation has been held up as a solution for all difficulties related to productivity issues, labour costs, a way to ensure consistently, streamlined production processes across the system. Accurate and immediate delivery of information to customers is a major factor in running a successful online Business, especially in the price sensitive and competitive Travel and Hospitality industry. Chatbots particularly have gotten a lot of attention from the hospitality industry in recent months.

Chatbots can help hotels in a number of areas, including time management, guest services and cost reduction. They can assist guests with elementary questions and requests. Thus, freeing up hotel staff to devote more of their time and attention to time-sensitive, critical, and complicated tasks. They are often more cost effective and faster than their human counterparts. They can be programmed to speak to guests in different languages, making it easier for the guests to speak in their local language to communicate.

Chatbots in Health Industry

Chatbots are a much better fit for patient engagement than Standalone apps. Through these Health-Bots, users can ask health related questions and receive immediate responses. These responses are either original or based on responses to similar questions in the database. The impersonal nature of a bot could act as a benefit in certain situations, where an actual Doctor is not needed.

Chatbots ease the access to healthcare and industry has favourable chances to serve their customers with personalised health tips. It can be a good example of the success of Chatbots and Service Industry combo.

Chatbots in E-Commerce

Mobile messengers- connected with Chatbots and the E-commerce business can open a new channel for selling the products online. E-commerce Shopping destination “Spring” was the early adopter. E-commerce future is where brands have their own Chatbots which can interact with their customers through their apps.

Chatbots in Fashion Industry

Chatbots, AI and Machine Learning pave a new domain of possibilities in the Fashion industry, from Data Analytics to Personal Chatbot Stylists. Fashion is such an industry where luxury goods can only be bought in a few physical boutiques and one to one customer service is essential. The Internet changed this dramatically, by giving the customers a seamless but a very impersonal experience of shopping. This particular problem can be solved by Chatbots. Customers can be treated personally with bots, which can exchange messages, give required suggestions and information. Famous fashion brands like Burberry, Tommy Hilfiger have recently launched Chatbots for the London and New York Fashion Week respectively. Sephora a famous cosmetics brand and H&M- a fashion clothing brand have also launched their Chatbots.

Chatbots in Finance

Chatbots have already stepped in Finance Industry. Chatbots can be programmed to assist the customers as Financial Advisor, Expense Saving Bot, Banking Bots, Tax bots, etc. Banks and Fintech have ample opportunities in developing bots for reducing their costs as well as human errors. Chatbots can work for customer's convenience, managing multiple accounts, directly checking their bank balance and expenses on particular things. Further about Finance and Chatbots have been discussed in our earlier blog: Chatbots as your Personal Finance Assistant.

Chatbots in Fitness Industry

Chat based health and fitness companies using Chatbot, to help their customers get personalised health and fitness tips. Tech based fitness companies can have a huge opportunity by developing their own Chatbots offering huge customer base with personalised services. Engage with your fans like never before with news, highlights, game-day info, roster and more.

Chatbots and Service Industry together have a wide range of opportunities and small to big all size of companies using chatbots to reduce their work and help their customers better.

Chatbots in Media

Big publisher or small agency, our suite of tools can help your audience chatbot experience rich and frictionless. Famous News and Media companies like The Wall Street Journal, CNN, Fox news, etc have launched their bots to help you receive the latest news on the go.

Chatbot in Celebrity:

With a chatbot you can now have one-on-one conversation with millions of fans.

Chatbot in Marketing

SMS Marketing

- Why promote just a coupon code that the customer does not know how to use?
- Improve conversions from your existing SMS campaigns.
- Talk to your customers when they want to use “Talk to an Agent” feature.

Email Marketing

- So your eMail has made a solid elevator pitch about your product.
- As a next step, is making customers fill an online form the most exciting way to engage with your customers?
- It's time to rethink the landing page.
- Instantly engage in a conversation with your customers.
- Address their concerns and queries

Social Media Triage

- How effectively are you addressing the negative sentiment around your brand on social media?
- Addressing queries instantly and effectively can convert even an angry customer into a loyal fan.
- Leverage a chatbot as your first response strategy and comfort that customer.

Process

Stage #1: Chatty Bot welcomes you

Teach your assistant to introduce itself in the console.

Stage #2: Print your name

Introduce yourself to the bot.

Stage #3: Guess the age

Use your knowledge of strings and numbers to make the assistant guess your age.

Stage #4: Learning numbers

Your assistant is old enough to learn how to count. And you are experienced enough to apply a for loop at this stage!

Stage #5: Multiple Choice

At this point, the assistant will be able to check your knowledge and ask multiple-choice questions. Add some functions to your code and make the stage even better.

How To Run The Project?

To run this project, you must have installed [Python](#) on your PC. After downloading the project, follow the steps below:

Step1: Extract/Unzip the file

Step2: Go inside the project folder, open cmd then type bot.py and enter to start the system.

OR

Step2: Simply, double-click the bot.py file and you are ready to go.

Group-C

6. Implement any one of the following Expert System

- I. Information management
- II. Hospitals and medical facilities
- III. Help desks management
- IV. Employee performance evaluation
- V. Stock market trading
- VI. Airline scheduling and cargo schedules

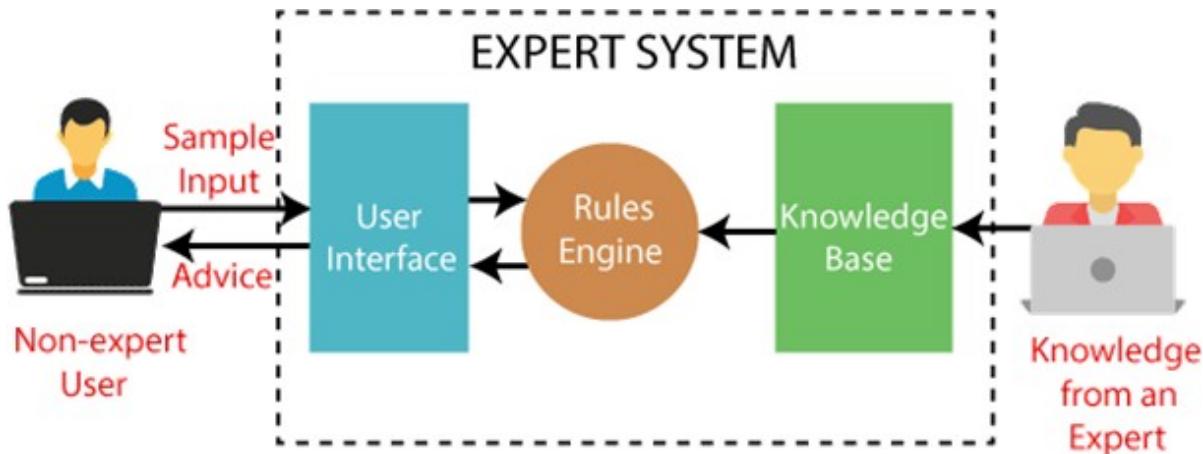
What is an Expert System?

An expert system is a computer program that is designed to solve complex problems and to provide decision-making ability like a human expert. It performs this by extracting knowledge from its knowledge base using the reasoning and inference rules according to the user queries.

The expert system is a part of AI, and the first ES was developed in the year 1970, which was the first successful approach of artificial intelligence. It solves the most complex issue as an expert by extracting the knowledge stored in its knowledge base. The system helps in decision making for complex problems using **both facts and heuristics like a human expert**. It is called so because it contains the expert knowledge of a specific domain and can solve any complex problem of that particular domain. These systems are designed for a specific domain, such as **medicine, science, etc.**

The performance of an expert system is based on the expert's knowledge stored in its knowledge base. The more knowledge stored in the KB, the more that system improves its performance. One of the common examples of an ES is a suggestion of spelling errors while typing in the Google search box.

Below is the block diagram that represents the working of an expert system:



Below are some popular examples of the Expert System:

- **DENDRAL:** It was an artificial intelligence project that was made as a chemical analysis expert system. It was used in organic chemistry to detect unknown organic molecules with the help of their mass spectra and knowledge base of chemistry.
- **MYCIN:** It was one of the earliest backward chaining expert systems that was designed to find the bacteria causing infections like bacteraemia and meningitis. It was also used for the recommendation of antibiotics and the diagnosis of blood clotting diseases.
- **PXDES:** It is an expert system that is used to determine the type and level of lung cancer. To determine the disease, it takes a picture from the upper body, which looks like the shadow. This shadow identifies the type and degree of harm.
- **CaDeT:** The CaDet expert system is a diagnostic support system that can detect cancer at early stages.

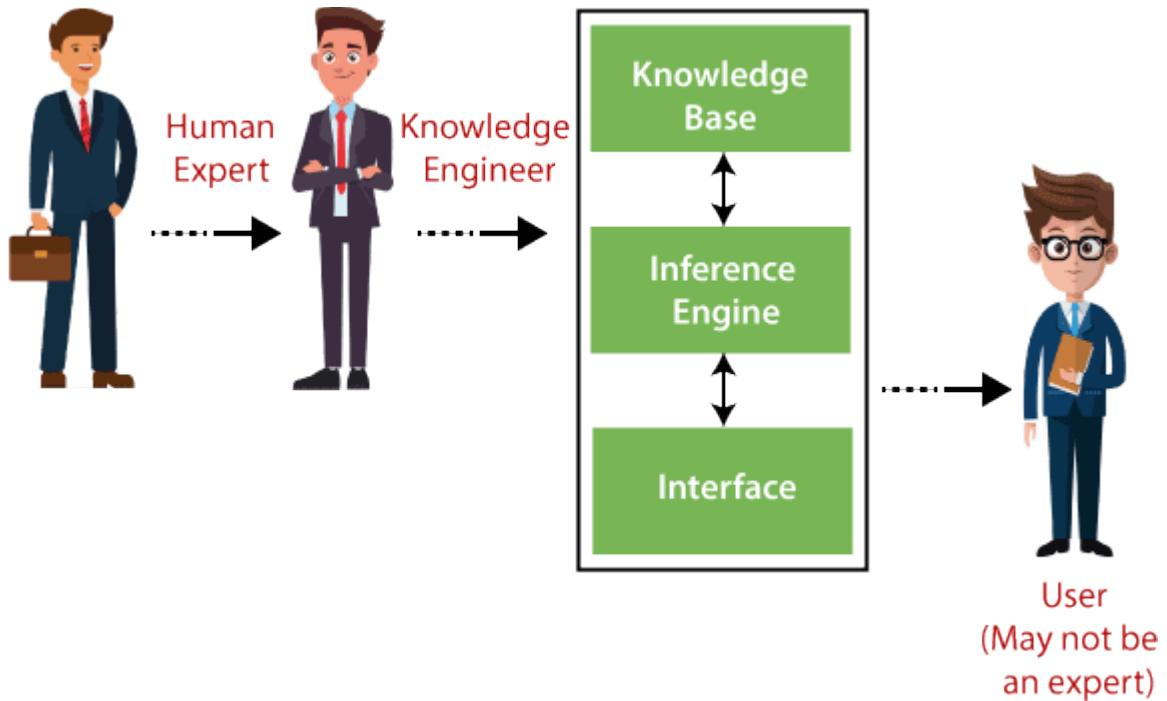
Characteristics of Expert System

- **High Performance:** The expert system provides high performance for solving any type of complex problem of a specific domain with high efficiency and accuracy.
- **Understandable:** It responds in a way that can be easily understandable by the user. It can take input in human language and provides the output in the same way.
- **Reliable:** It is much reliable for generating an efficient and accurate output.
- **Highly responsive:** ES provides the result for any complex query within a very short period of time.

Components of Expert System

An expert system mainly consists of three components:

- o User Interface
- o Inference Engine
- o Knowledge Base



Participants in the development of Expert System

There are three primary participants in the building of Expert System:

1. **Expert:** The success of an ES much depends on the knowledge provided by human experts. These experts are those persons who are specialized in that specific domain.
2. **Knowledge Engineer:** Knowledge engineer is the person who gathers the knowledge from the domain experts and then codifies that knowledge to the system according to the formalism.
3. **End-User:** This is a particular person or a group of people who may not be experts, and working on the expert system needs the solution or advice for his queries, which are complex.

Advantages of Expert System

- o These systems are highly reproducible.
- o They can be used for risky places where the human presence is not safe.

- Error possibilities are less if the KB contains correct knowledge.
- The performance of these systems remains steady as it is not affected by emotions, tension, or fatigue.
- They provide a very high speed to respond to a particular query.

Limitations of Expert System

- The response of the expert system may get wrong if the knowledge base contains the wrong information.
- Like a human being, it cannot produce a creative output for different scenarios.
- Its maintenance and development costs are very high.
- Knowledge acquisition for designing is much difficult.
- For each domain, we require a specific ES, which is one of the big limitations.
- It cannot learn from itself and hence requires manual updates.

Applications of Expert System

- **In designing and manufacturing domain**

It can be broadly used for designing and manufacturing physical devices such as camera lenses and automobiles.

- **In the knowledge domain**

These systems are primarily used for publishing the relevant knowledge to the users. The two popular ES used for this domain is an advisor and a tax advisor.

- **In the finance domain**

In the finance industries, it is used to detect any type of possible fraud, suspicious activity, and advise bankers that if they should provide loans for business or not.

- **In the diagnosis and troubleshooting of devices**

In medical diagnosis, the ES system is used, and it was the first area where these systems were used.

- **Planning and Scheduling**

The expert systems can also be used for planning and scheduling some particular tasks for achieving the goal of that task.



Cloud Computing lab manual

Computer Engineering (Savitribai Phule Pune University)



Scan to open on Studocu

SNJB's Late Sau. K. B. Jain College of Engineering, Chandwad

Department of Computer Engineering

Course Name:Laboratory Practice II(310258):Cloud Computing

Class:Third Year (TE) Div A/ Div B

Batch:T1/T2/T3/T4

Name:

Roll No:

Assignment No: 7

Answers (A) – 5M	Coding Efficiency (C) – 5M	Viva (V) – 5M	Timely Completion (T) – 5M	Total(20M)	Sign

Date of Performance:..... **Date of Completion:**.....

1. Title of Assignment:

Case study on Microsoft azure to learn about Microsoft Azure is a cloud computing platform and infrastructure, created by Microsoft, for building, deploying and managing applications and services through a global network of Microsoft-managed data centers.

2. Objective:

1. Study of Microsoft Azure Cloud Platform
2. Create a static HTML web app in Azure

3. Outcome: Use tools and techniques in the area of Cloud Computing

4. Software and Hardware Requirement:

Software Requirement: Latest Browser, www.azure.com

Hardware Requirement: Internet Connection, PC with Min. 2GB RAM, Core i5 Processor

5.Relevant Theory :

What is Azure?

- Azure is a complete cloud platform that can host your existing applications and streamline new application development.

- Azure can even enhance on-premises applications.
- Azure integrates the cloud services that you need to develop, test, deploy, and manage your applications, all while taking advantage of the efficiencies of cloud computing.
- By hosting your applications in Azure, you can start small and easily scale your application as your customer demand grows.
- Azure also offers the reliability that's needed for high-availability applications, even including failover between different regions.
- The [Azure portal](#) lets you easily manage all your Azure services.
- You can also manage your services programmatically by using service-specific APIs and templates.
- This guide is an introduction to the Azure platform for application developers.
- It provides guidance and direction that you need to start building new applications in Azure or migrating existing applications to Azure.

Where do I start?

- With all the services that Azure offers, it can be an intimidating task to figure out which services you need to support your solution architecture.
- This section highlights the Azure services that developers commonly use.
- For a list of all Azure services, see the [Azure documentation](#).
- First, you must decide on how to host your application in Azure.
- Do you need to manage your entire infrastructure as a virtual machine (VM)? Can you use the platform management facilities that Azure provides? Maybe you need a serverless framework to host code execution only?
- Your application needs cloud storage, which Azure provides several options for. You can take advantage of Azure's enterprise authentication.
- There are also tools for cloud-based development and monitoring, and most hosting services offer DevOps integration.

Now, let's look at some of the specific services that we recommend investigating for your applications.

Application hosting

- Azure provides several cloud-based compute offerings to run your application so that you don't have to worry about the infrastructure details.
- You can easily scale up or scale out your resources as your application usage grows.
- Azure offers services that support your application development and hosting needs.

- Azure provides Infrastructure as a Service (IaaS) to give you full control over your application hosting.
- Azure's Platform as a Service (PaaS) offerings provide the fully managed services needed to power your apps.
- There's even true serverless hosting in Azure where all you need to do is write your code.

Azure App Service

- When you want the quickest path to publish your web-based projects, consider Azure App Service.
- App Service makes it easy to extend your web apps to support your mobile clients and publish easily consumed REST APIs.
- This platform provides authentication by using social providers, traffic-based auto scaling, testing in production, and continuous and container-based deployments.

You can create web apps, mobile app back ends, and API apps.

- Because all three app types share the App Service runtime, you can host a website, support mobile clients, and expose your APIs in Azure, all from the same project or solution.
- To learn more about App Service, see

What is Azure Web Apps.

- App Service has been designed with DevOps in mind.
- It supports various tools for publishing and continuous integration deployments.
- These tools include GitHub webhooks, Jenkins, Azure DevOps, TeamCity, and others.
- You can migrate your existing applications to App Service by using the [online migration tool](#).
- **When to use:** Use App Service when you're migrating existing web applications to Azure, and when you need a fully-managed hosting platform for your web apps.
- You can also use App Service when you need to support mobile clients or expose REST APIs with your app.

Get started: App Service makes it easy to create and deploy your first [web app](#), [mobile app](#), or [API app](#).

Try it now: App Service lets you provision a short-lived app to try the platform without having to sign up for an Azure account. Try the platform and [create your Azure App Service app](#).

Azure Virtual Machines

- As an Infrastructure as a Service (IaaS) provider, Azure lets you deploy to or migrate your application to either Windows or Linux VMs.
- Together with Azure Virtual Network, Azure Virtual Machines supports the deployment of Windows or Linux VMs to Azure.
- With VMs, you have total control over the configuration of the machine.
- When using VMs, you're responsible for all server software installation, configuration, maintenance, and operating system patches.
- Because of the level of control that you have with VMs, you can run a wide range of server workloads on Azure that don't fit into a PaaS model.
- These workloads include database servers, Windows Server Active Directory, and Microsoft SharePoint.

When to use: Use Virtual Machines when you want full control over your application infrastructure or to migrate on-premises application workloads to Azure without having to make changes.

- Create a [Linux VM](#) or [Windows VM](#) from the Azure portal.

Azure Functions (serverless)

- Rather than worrying about building out and managing a whole application or the infrastructure to run your code, what if you could just write your code and have it run in response to events or on a schedule? [Azure Functions](#) is a "serverless"-style offering that lets you write just the code you need.
- With Functions, you can trigger code execution with HTTP requests, webhooks, cloud service events, or on a schedule.
- You can code in your development language of choice, such as C#, F#, Node.js, Python, or PHP. With consumption-based billing, you pay only for the time that your code executes, and Azure scales as needed.

When to use: Use Azure Functions when you have code that is triggered by other Azure services, by web-based events, or on a schedule.

You can also use Functions when you don't need the overhead of a complete hosted project or when you only want to pay for the time that your code runs.

To learn more, see [Azure Functions Overview](#).

- Follow the Functions quickstart tutorial to [create your first function](#) from the portal.
- Azure Functions lets you run your code without having to sign up for an Azure account. Try it now and [create your first Azure Function](#).

Azure Service Fabric

- Azure Service Fabric is a distributed systems platform.
- This platform makes it easy to build, package, deploy, and manage scalable and reliable microservices.
- It also provides comprehensive application management capabilities such as:
 - Provisioning
 - Deploying
 - Monitoring
 - Upgrading/Patching
 - Deleting
- Apps, which run on a shared pool of machines, can start small and scale to hundreds or thousands of machines as needed.
- Service Fabric supports WebAPI with Open Web Interface for .NET (OWIN) and ASP.NET Core.
- It provides SDKs for building services on Linux in both .NET Core and Java.
- To learn more about Service Fabric, see the [Service Fabric documentation](#).

When to use: Service Fabric is a good choice when you're creating an application or rewriting an existing application to use a microservice architecture. Use Service Fabric when you need more control over, or direct access to, the underlying infrastructure.

Get started: [Create your first Azure Service Fabric application](#).

Azure Spring Cloud

- Azure Spring Cloud is a serverless microservices platform that enables you to build, deploy, scale and monitor your applications in the cloud.
- Use Spring Cloud to bring modern microservice patterns to Spring Boot apps, eliminating boilerplate code to quickly build robust Java apps.
 - Leverage managed versions of Spring Cloud Service Discovery and Config Server, while we ensure those critical components are running in optimum conditions.

- Focus on building your business logic and we will take care of your service runtime with security patches, compliance standards and high availability.
- Manage application lifecycle (for example, deploy, start, stop, scale) on top of Azure Kubernetes Service.
- Easily bind connections between your apps and Azure services such as Azure Database for MySQL and Azure Cache for Redis.
- Monitor and troubleshoot microservices and applications using enterprise-grade unified monitoring tools that offer deep insights on application dependencies and operational telemetry.

When to use: As a fully managed service Azure Spring Cloud is a good choice when you're minimizing operational cost running Spring Boot/Spring Cloud based microservices on Azure.

Get started: [Deploy your first Spring Boot app in Azure Spring Cloud.](#)

Enhance your applications with Azure services

Along with application hosting, Azure provides service offerings that can enhance the functionality. Azure can also improve the development and maintenance of your applications, both in the cloud and on-premises.

Hosted storage and data access

Most applications must store data, so however you decide to host your application in Azure, consider one or more of the following storage and data services.

- **Azure Cosmos DB:** A globally distributed, multi-model database service. This database enables you to elastically scale throughput and storage across any number of geographical regions with a comprehensive SLA.

When to use: When your application needs document, table, or graph databases, including MongoDB databases, with multiple well-defined consistency models.

- **Azure Storage:** Offers durable, highly available storage for blobs, queues, files, and other kinds of nonrelational data. Storage provides the storage foundation for VMs.

When to use: When your app stores nonrelational data, such as key-value pairs (tables), blobs, files shares, or messages (queues).

- **Azure SQL Database:** An Azure-based version of the Microsoft SQL Server engine for storing relational tabular data in the cloud. SQL Database provides predictable performance, scalability with no downtime, business continuity, and data protection.

When to use: When your application requires data storage with referential integrity, transactional support, and support for TSQL queries.

- You can use [Azure Data Factory](#) to move existing on-premises data to Azure.
- If you aren't ready to move data to the cloud, [Hybrid Connections](#) in Azure App Service lets you connect your App Service hosted app to on-premises resources.
- You can also connect to Azure data and storage services from your on-premises applications.

Docker support

- Docker containers, a form of OS virtualization, let you deploy applications in a more efficient and predictable way.
- A containerized application works in production the same way as on your development and test systems.
- You can manage containers by using standard Docker tools.
- You can use your existing skills and popular open-source tools to deploy and manage container-based applications on Azure.

Azure provides several ways to use containers in your applications.

- **Azure Kubernetes Service:** Lets you create, configure, and manage a cluster of virtual machines that are preconfigured to run containerized applications. To learn more about Azure Kubernetes Service, see [Azure Kubernetes Service introduction](#).

When to use: When you need to build production-ready, scalable environments that provide additional scheduling and management tools, or when you're deploying a Docker Swarm cluster.

Get started: [Deploy a Kubernetes Service cluster](#).

- **Docker Machine:** Lets you install and manage a Docker Engine on virtual hosts by using docker-machine commands.

When to use: When you need to quickly prototype an app by creating a single Docker host.

- **Custom Docker image for App Service:** Lets you use Docker containers from a container registry or a customer container when you deploy a web app on Linux.

When to use: When deploying a web app on Linux to a Docker image.

Get started: [Use a custom Docker image for App Service on Linux](#).

Authentication

- It's crucial to not only know who is using your applications, but also to prevent unauthorized access to your resources. Azure provides several ways to authenticate your app clients.
 - **Azure Active Directory (Azure AD):** The Microsoft multitenant, cloud-based identity and access management service. You can add single-sign on (SSO) to your applications by integrating with Azure AD. You can access directory properties by using the Microsoft Graph API. You can integrate with Azure AD support for the OAuth2.0 authorization framework and Open ID Connect by using native HTTP/REST endpoints and the multiplatform Azure AD authentication libraries.

When to use: When you want to provide an SSO experience, work with Graph-based data, or authenticate domain-based users.

Get started: To learn more, see the [Azure Active Directory developer's guide](#).

- **App Service Authentication:** When you choose App Service to host your app, you also get built-in authentication support for Azure AD, along with social identity providers— including Facebook, Google, Microsoft, and Twitter.

When to use: When you want to enable authentication in an App Service app by using Azure AD, social identity providers, or both.

Get started: To learn more about authentication in App Service, see [Authentication and authorization in Azure App Service](#).

To learn more about security best practices in Azure, see [Azure security best practices and patterns](#).

Monitoring

With your application up and running in Azure, you need to monitor performance, watch for issues, and see how customers are using your app. Azure provides several monitoring options.

- **Application Insights:** An Azure-hosted extensible analytics service that integrates with Visual Studio to monitor your live web applications. It gives you the data that you need to improve the performance and usability of your apps continuously. This improvement occurs whether you host your applications on Azure or not.

Get started: Follow the [Application Insights tutorial](#).

- **Azure Monitor:** A service that helps you to visualize, query, route, archive, and act on the metrics and logs that you generate with your Azure infrastructure and resources. Monitor is a single source for monitoring Azure resources and provides the data views that you see in the Azure portal.

DevOps integration

Whether it's provisioning VMs or publishing your web apps with continuous integration, Azure integrates with most of the popular DevOps tools. You can work with the tools that you already have and maximize your existing experience with support for tools like:

- Jenkins
- GitHub
- Puppet
- Chef
- TeamCity
- Ansible
- Azure DevOps

Azure regions

- Azure is a global cloud platform that is generally available in many regions around the world. When you provision a service, application, or VM in Azure, you're asked to select a region.
- This region represents a specific datacenter where your application runs or where your data is stored.
- These regions correspond to specific locations, which are published on the [Azure regions](#) page.

Choose the best region for your application and data

- One of the benefits of using Azure is that you can deploy your applications to various datacenters around the globe.
- The region that you choose can affect the performance of your application.
- For example, it's better to choose a region that's closer to most of your customers to reduce latency in network requests.

- You might also want to select your region to meet the legal requirements for distributing your app in certain countries/regions.
- It's always a best practice to store application data in the same datacenter or in a datacenter as near as possible to the datacenter that is hosting your application.

Multi-region apps

- Although unlikely, it's not impossible for an entire datacenter to go offline because of an event such as a natural disaster or Internet failure.
- It's a best practice to host vital business applications in more than one datacenter to provide maximum availability.
- Using multiple regions can also reduce latency for global users and provide additional opportunities for flexibility when updating applications.
- Some services, such as Virtual Machine and App Services, use [Azure Traffic Manager](#) to enable multi-region support with failover between regions to support high-availability enterprise applications.
- For an example, see [Azure reference architecture: Run a web application in multiple regions](#).

When to use: When you have enterprise and high-availability applications that benefit from failover and replication.

How do I manage my applications and projects?

Azure provides a rich set of experiences for you to create and manage your Azure resources, applications, and projects—both programmatically and in the [Azure portal](#).

Command-line interfaces and PowerShell

Azure provides two ways to manage your applications and services from the command line. You can use tools like Bash, Terminal, the command prompt, or your command-line tool of choice. Usually, you can do the same tasks from the command line as in the Azure portal—such as creating and configuring virtual machines, virtual networks, web apps, and other services.

- [Azure CLI](#): Lets you connect to an Azure subscription and program various tasks against Azure resources from the command line.
- [Azure PowerShell](#): Provides a set of modules with cmdlets that enable you to manage Azure resources by using Windows PowerShell.

Azure portal

The [Azure portal](#) is a web-based application. You can use the Azure portal to create, manage, and remove Azure resources and services. It includes:

- A configurable dashboard
- Azure resource management tools
 - Access to subscription settings and billing information For more information, see the [Azure portal overview](#).

REST APIs

Azure is built on a set of REST APIs that support the Azure portal UI. Most of these REST APIs are also supported to let you programmatically provision and manage your Azure resources and applications from any Internet-enabled device. For the complete set of REST API documentation, see the [Azure REST SDK reference](#).

APIs

- Along with REST APIs, many Azure services also let you programmatically manage resources from your applications by using platform-specific Azure SDKs, including SDKs for the following development platforms:
 - [.NET](#)
 - [Node.js](#)
 - [Java](#)
 - [PHP](#)
 - [Python](#)
 - [Ruby](#)
 - [Go](#)

Services such as [Mobile Apps](#) and [Azure Media Services](#) provide client-side SDKs to let you access services from web and mobile client apps.

Azure Resource Manager

- Running your app on Azure likely involves working with multiple Azure services. These services follow the same life cycle and can be thought of as a logical unit.
- For example, a web app might use Web Apps, SQL Database, Storage, Azure Cache for Redis, and Azure Content Delivery Network services.
- [Azure Resource Manager](#) lets you work with the resources in your application as a group. You can deploy, update, or delete all the resources in a single, coordinated operation.

Along with logically grouping and managing related resources, Azure Resource Manager includes deployment capabilities that let you customize the deployment and configuration of related resources. For example, you can use Resource Manager deploy and configure an application. This application can consist of multiple virtual machines, a load balancer, and a database in Azure SQL Database as a single unit.

- You develop these deployments by using an Azure Resource Manager template, which is a JSON-formatted document.
- Templates let you define a deployment and manage your applications by using declarative templates, rather than scripts. Your templates can work for different environments, such as testing, staging, and production. For example, you can use templates to add a button to a GitHub repo that deploys the code in the repo to a set of Azure services with a single click.

When to use: Use Resource Manager templates when you want a template-based deployment for your app that you can manage programmatically by using REST APIs, the Azure CLI, and Azure PowerShell.

Get started: To get started using templates, see [Authoring Azure Resource Manager templates](#).

Understanding accounts, subscriptions, and billing:

- As developers, we like to dive right into the code and try to get started as fast as possible with making our applications run.
- We certainly want to encourage you to start working in Azure as easily as possible. To help make it easy, Azure offers a [free trial](#).
- Some services even have a "Try it for free" functionality, like [Azure App Service](#), which doesn't require you to even create an account.
- As fun as it is to dive into coding and deploying your application to Azure, it's also important to take some time to understand how Azure works.
- Specifically, you should understand how it works from a standpoint of user accounts, subscriptions, and billing.

What is an Azure account?

- To create or work with an Azure subscription, you must have an Azure account.
- An Azure account is simply an identity in Azure AD or in a directory, such as a work or school organization, that Azure AD trusts.

- If you don't belong to such an organization, you can always create a subscription by using your Microsoft Account, which is trusted by Azure AD.
- To learn more about integrating on-premises Windows Server Active Directory with Azure AD,
- Every Azure subscription has a trust relationship with an Azure AD instance. This means that it trusts that directory to authenticate users, services, and devices.
- Multiple subscriptions can trust the same directory, but a subscription trusts only one directory. To learn more, see [How Azure subscriptions are associated with Azure Active Directory](#).
- As well as defining individual Azure account identities, also called *users*, you can define *groups* in Azure AD.
- Creating user groups is a good way to manage access to resources in a subscription by using role-based access control (RBAC).
- To learn how to create groups, see [Create a group in Azure Active Directory preview](#). You can also create and manage groups by [using PowerShell](#).

Manage your subscriptions

- A subscription is a logical grouping of Azure services that is linked to an Azure account. A single Azure account can contain multiple subscriptions.
- Billing for Azure services is done on a per-subscription basis. For a list of the available subscription offers by type, see [Microsoft Azure Offer Details](#).
- Azure subscriptions have an Account Administrator who has full control over the subscription.
- They also have a Service Administrator who has control over all services in the subscription.
- For information about classic subscription administrators, see [Add or change Azure subscription administrators](#). Individual accounts can be granted detailed control of Azure resources using [Azure role-based access control \(Azure RBAC\)](#).

Resource groups

- When you provision new Azure services, you do so in a given subscription. Individual Azure services, which are also called resources, are created in the context of a resource group. Resource groups make it easier to deploy and manage your application's resources.
- A resource group should contain all the resources for your application that you want to work with as a unit.
- You can move resources between resource groups and even to different subscriptions.

The Azure Resource Explorer is a great tool for visualizing the resources that you've already created in your subscription. To learn more, see [Use Azure Resource Explorer to view and modify resources](#).

Grant access to resources

When you allow access to Azure resources, it's always a best practice to provide users with the least privilege that's required to do a given task.

- **Azure role-based access control (Azure RBAC):** In Azure, you can grant access to user accounts (principals) at a specified scope: subscription, resource group, or individual resources. Azure RBAC lets you deploy resources into a resource group and grant permissions to a specific user or group. It also lets you limit access to only the resources that belong to the target resource group. You can also grant access to a single resource, such as a virtual machine or virtual network. To grant access, you assign a role to the user, group, or service principal. There are many predefined roles, and you can also define your own custom roles.

When to use: When you need fine-grained access management for users and groups or when you need to make a user an owner of a subscription.

- **Service principal objects:** Along with providing access to user principals and groups, you can grant the same access to a service principal.

When to use: When you're programmatically managing Azure resources or granting access for applications. For more information, see [Create Active Directory application and service principal](#).

Tags

Azure Resource Manager lets you assign custom tags to individual resources. Tags, which are key-value pairs, can be helpful when you need to organize resources for billing or monitoring.

Tags provide you a way to track resources across multiple resource groups. You can assign tags the following ways:

- In the portal
- In the Azure Resource Manager template
- Using the REST API
- Using the Azure CLI
- Using PowerShell

You can assign multiple tags to each resource. To learn more, see [Using tags to organize your Azure resources](#).

Billing

In the move from on-premises computing to cloud-hosted services, tracking and estimating service usage and related costs are significant concerns. It's important to estimate what new resources cost to run on a monthly basis. You can also project how the billing looks for a given month based on the current spending.

Get resource usage data

Azure provides a set of Billing REST APIs that give access to resource consumption and metadata information for Azure subscriptions. These Billing APIs give you the ability to better predict and manage Azure costs. You can track and analyze spending in hourly increments and create spending alerts. You can also predict future billing based on current usage trends.

Get started: To learn more about using the Billing APIs, see [Azure consumption API overview](#)

Predict future costs

Although it's challenging to estimate costs ahead of time, Azure has tools that can help. It has a [pricing calculator](#) to help estimate the cost of deployed resources. You can also use the Billing resources in the portal and the Billing REST APIs to estimate future costs, based on current consumption.

Create a static HTML web app in Azure

[Azure App Service](#) provides a highly scalable, self-patching web hosting service. This quickstart shows how to deploy a basic HTML+CSS site to Azure App Service. You'll complete this quickstart in [Cloud Shell](#), but you can also run these commands locally with [Azure CLI](#).

If you don't have an [Azure subscription](#), create an [Azure free account](#) before you begin.

Use Azure Cloud Shell

Azure hosts Azure Cloud Shell, an interactive shell environment that you can use through your browser. You can use either Bash or PowerShell with Cloud Shell to work with Azure services. You can use the Cloud Shell preinstalled commands to run the code in this article without having to install anything on your local environment.

To start Azure Cloud Shell:

Select **Try It** in the upper-right corner of a code block. Selecting **Try It** doesn't automatically copy the code to Cloud Shell.

Go to <https://shell.azure.com>, or select the **Launch Cloud Shell** button to open Cloud Shell in your browser.

Select the **Cloud Shell** button on the menu bar at the upper right in the [Azure portal](#).

To run the code in this article in Azure Cloud Shell:

1. Start Cloud Shell.
2. Select the **Copy** button on a code block to copy the code.
3. Paste the code into the Cloud Shell session by selecting **Ctrl+Shift+V** on Windows and Linux or by selecting **Cmd+Shift+V** on macOS.
4. Select **Enter** to run the code.

Download the sample

In the Cloud Shell, create a quickstart directory and then change to it.

mkdir quickstart

cd \$HOME/quickstart

Next, run the following command to clone the sample app repository to your quickstart directory.

git clone <https://github.com/Azure-Samples/html-docs-hello-world.git>

Create a web app

Change to the directory that contains the sample code and run the az webapp up command. In the following example, replace <app_name> with a unique app name. Static content is indicated by the --html flag.

Bash

cd html-docs-hello-world

az webapp up --location westeurope --name <app_name> --html

The az webapp up command does the following actions:

- Create a default resource group.

- Create a default app service plan.
- Create an app with the specified name.
- [Zip deploy](#) files from the current working directory to the web app.

This command may take a few minutes to run. While running, it displays information similar to the following example:

Output

```
{
  "app_url": "https://<app_name>.azurewebsites.net", "location": "westeurope",
  "name": "<app_name>",
  "os": "Windows",
  "resourcegroup": "appsvc_rg_Windows_westeurope", "serverfarm": "appsvc_asp_Windows_westeurope", "sku": "FREE",
  "src_path": "/home/<username>/quickstart/html-docs-hello-world ", &lt; JSON data removed for brevity. &gt;
}
```

Make a note of the resourceGroup value. You need it for the [clean up resources](#) section.

Browse to the app

In a browser, go to the app URL: http://<app_name>.azurewebsites.net. The page is running as an Azure App Service web app.

Congratulations! You've deployed your first HTML app to App Service.

Update and redeploy the app

- In the Cloud Shell, type nano index.html to open the nano text editor. In the <h1> heading tag, change "Azure App Service - Sample Static HTML Site" to "Azure App Service", as shown below.
- Save your changes and exit nano. Use the command ^O to save and ^X to exit. You'll now redeploy the app with the same az webapp up command.

Bash

```
az webapp up --location westeurope --name <app_name> --html
```

Once deployment has completed, switch back to the browser window that opened in the **Browse to the app** step, and refresh the page.

Manage your new Azure app

To manage the web app you created, in the [Azure portal](#), search for and select **App Services**.

On the **App Services** page, select the name of your Azure app.

You see your web app's Overview page. Here, you can perform basic management tasks like browse, stop, start, restart, and delete.

The left menu provides different pages for configuring your app.

Clean up resources

In the preceding steps, you created Azure resources in a resource group. If you don't expect to need these resources in the future, delete the resource group by running the following command in the Cloud Shell. Remember that the resource group name was automatically generated for you in the [create a web app](#) step.

Bash

```
az group delete --name appsvc_rg_Windows_westeurope This command may take a minute to run.
```

6.Frequently Asked Questions:

- i) What is Azure?
- ii) What is Azure Virtual Machine?
- iii) What is Azure App Service?
- iv) What is Azure Service Fabric?
- v) What is Azure Spring Cloud?
- vi) What is difference between Microsoft Azur, Google Cloud, Amazon EC2

7.Conclusion:

Successfully studied Microsoft Azure Platform and created a static HTML web app in Azure

SNJB's Late Sau. K. B. Jain College of Engineering, Chandwad

Department of Computer Engineering

Course Name:Laboratory Practice II(310258):Cloud Computing

Class:Third Year (TE) Div A/ Div B

Batch:T1/T2/T3/T4

Name:

Roll No:

Assignment No: 8

Answers (A) – 5M	Coding Efficiency (C) – 5M	Viva (V) – 5M	Timely Completion (T) – 5M	Total(20M)	Sign

Date of Performance:..... .**Date of Completion:**.....

1. Title of Assignment:

Installation and configure Google App Engine.

2. Objective:

1. Install and Configure Google App Engine
2. Create a simple code in python on Github and execute on Google App Engine

3. Outcome: Use tools and techniques in the area of Cloud Computing

4. Software and Hardware Requirement:

Software Requirement: 1.Console.cloud.google.com 2. Login to your Gmail account

Hardware Requirement: Internet Connection, PC with Min. 2GB RAM, Core i5 Processor

5.Relevant Theory :

Google App Engine :

Google App Engine (often referred to as GAE or simply App Engine) is a cloud computing platform as a service for developing and hosting web applications in Google-managed data centers. Applications are sandboxed and run across multiple servers. App Engine offers automatic scaling for web applications—as the number of requests increases for an application, App Engine automatically allocates more resources for the web application to handle the additional demand.

Google App Engine primarily supports Go, PHP, Java, Python, Node.js, .NET, and Ruby

applications, although it can also support other languages via "custom runtimes". The service is free up to a certain level of consumed resources and only in standard environment but not in flexible environment. Fees are charged for additional storage, bandwidth, or instance hours required by the application. It was first released as a preview version in April 2008 and came out of preview in September 2011.

Runtimes and framework

Python web frameworks that run on Google App Engine include Django, CherryPy, Pyramid, Flask, web2py and webapp2, as well as a custom Google- written webapp framework and several others designed specifically for the platform that emerged since the release. Any Python framework that supports the WSGI using the CGI adapter can be used to create an application; the framework can be uploaded with the developed application. Third-party libraries written in pure Python may also be uploaded.

Google App Engine supports many Java standards and frameworks. Core to this is the servlet 2.5 technology using the open-source Jetty Web Server, along with accompanying technologies such as JSP. JavaServer Faces operates with some workarounds. A newer release of App Engine Standard Java in Beta supports Java8, Servlet 3.1 and Jetty9.

Though the integrated database, Google Cloud Datastore, may be unfamiliar to programmers, it is accessed and supported with JPA, JDO, and by the simple low-level API. There are several alternative libraries and frameworks you can use to model and map the data to the database such as Objectify, Slim3 and Jello framework.

The Spring Framework works with GAE. However, the Spring Security module (if used) requires workarounds. Apache Struts 1 is supported, and Struts 2 runs with workarounds.

The Django web framework and applications running on it can be used on App Engine with modification. Django-nonrel aims to allow Django to work with non-relational databases and the project includes support for App Engine.

Reliability and support

All billed App Engine applications have a 99.95% uptime SLA.

App Engine is designed in such a way that it can sustain multiple datacenter outages without any downtime. This resilience to downtime is shown by the statistic that the High Replication Datastore saw 0% downtime over a period of a year.

Paid support from Google engineers is offered as part of Premier Accounts.

Differences with other application hosting

Compared to other scalable hosting services such as Amazon EC2, App Engine provides more infrastructure to make it easy to write scalable applications, but can only run a limited range of applications designed for that infrastructure.

App Engine's infrastructure removes many of the system administration and development challenges of building applications to scale to hundreds of requests per second and beyond. Google handles deploying code to a cluster, monitoring, failover, and launching application instances as necessary. While other services let users install and configure nearly any *NIX compatible software, App Engine requires developers to use only its supported languages, APIs, and frameworks. Current APIs allow storing and retrieving data from the document-oriented Google Cloud Datastore database;

making HTTP requests; sending e-mail; manipulating images; and caching. Google Cloud SQL can be used for App Engine applications requiring a relational MySQL compatible database backend. Per-day and per-minute quotas restrict bandwidth and CPU use, number of requests served, number of concurrent requests, and calls to the various APIs, and individual requests are terminated if they take more than 60 seconds or return more than 32MB of data.

Differences between SQL and GQL

Google App Engine's integrated Google Cloud Datastore database has a SQL-like syntax called "GQL" (Google Query Language). GQL does not support the Join statement. Instead, one-to-many and many-to-many relationships can be accomplished using ReferenceProperty() .

Google Firestore is the successor to Google Cloud Datastore and replaces GQL with a document-based query method that treats stored objects as collections of documents.

Portability concerns

Developers worry that the applications will not be portable from App Engine and fear being locked into the technology. In response, there are a number of projects to create open-source back-ends for the various proprietary/closed APIs of app engine, especially the datastore. AppScale, CapeDwarf and TyphoonAE are a few of the open source efforts.

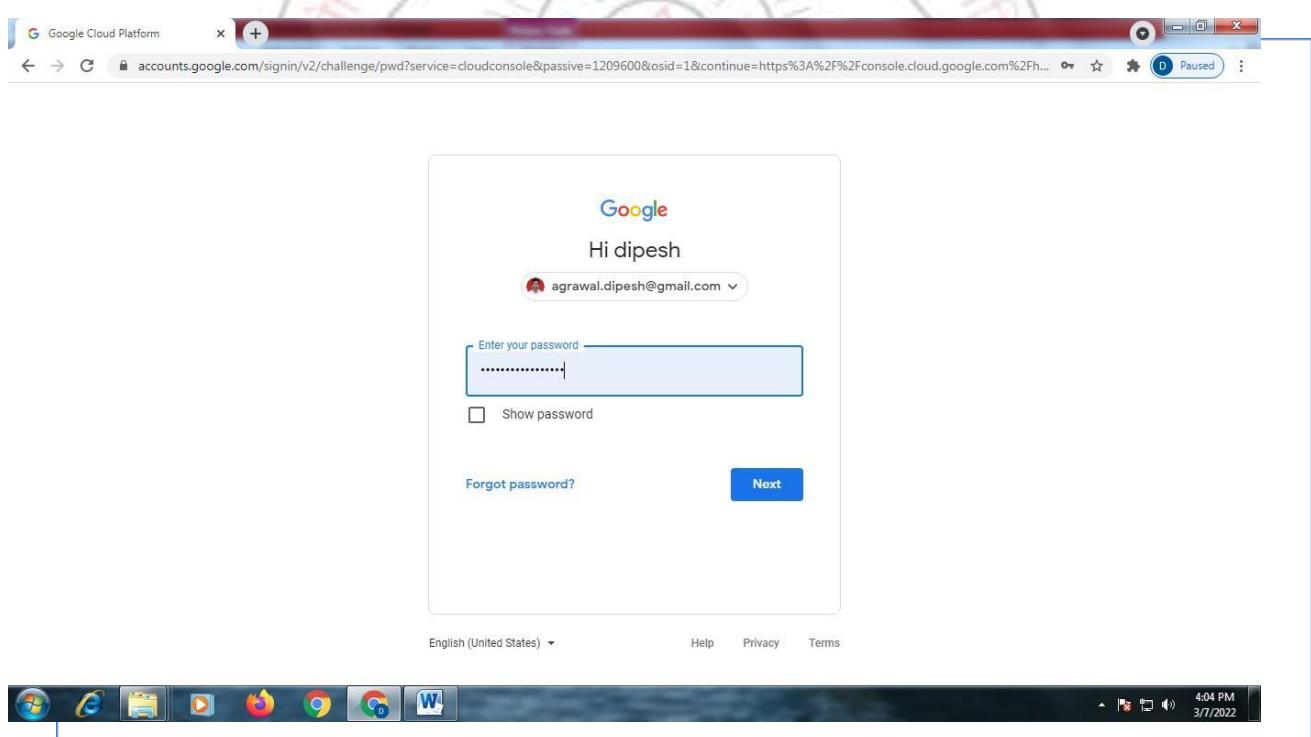
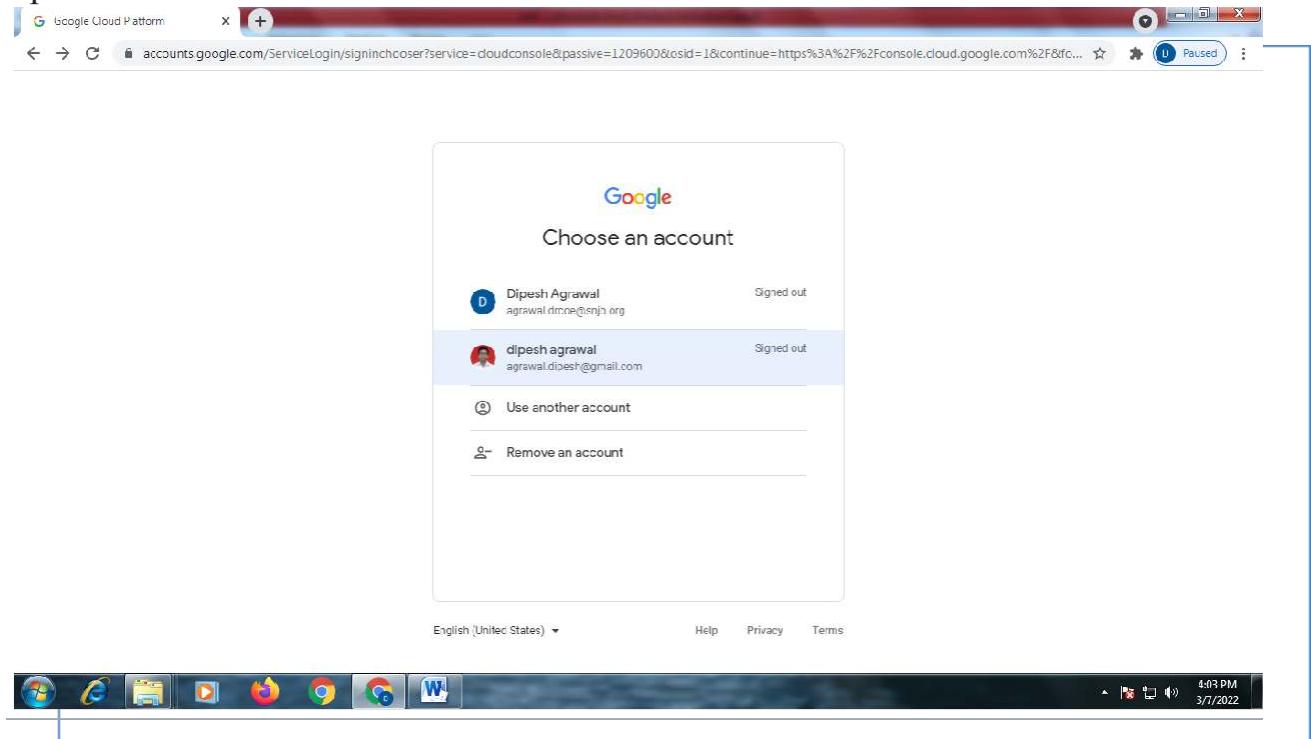
AppScale automatically deploys and scales unmodified Google App Engine applications over popular public and private cloud systems and on-premises clusters. AppScale can run Python, Java, PHP, and Go applications on EC2, Google Compute Engine, Softlayer, Azure and other cloud vendors.

TyphoonAE can run Python App Engine applications on any cloud that support linux machines.

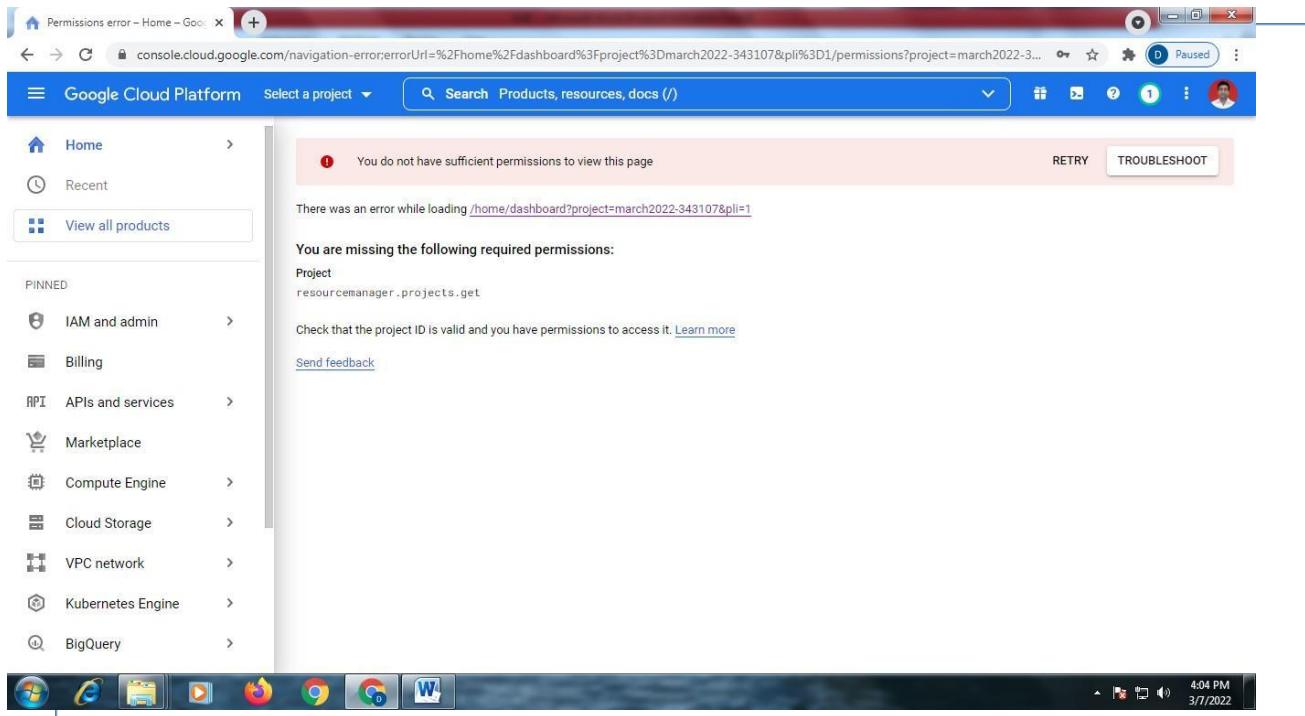
Web2py web framework offers migration between SQL Databases and Google App Engine, however it doesn't support several App Engine-specific features such as transactions and namespaces.

Kubernetes is an open-source job control system invented by Google to abstract away the infrastructure so that open-source (e.g. Docker) containerized applications can run on many types of infrastructure, such as Amazon Web Services, Microsoft Azure, and others. This is one of Google's answers to the portability concern.

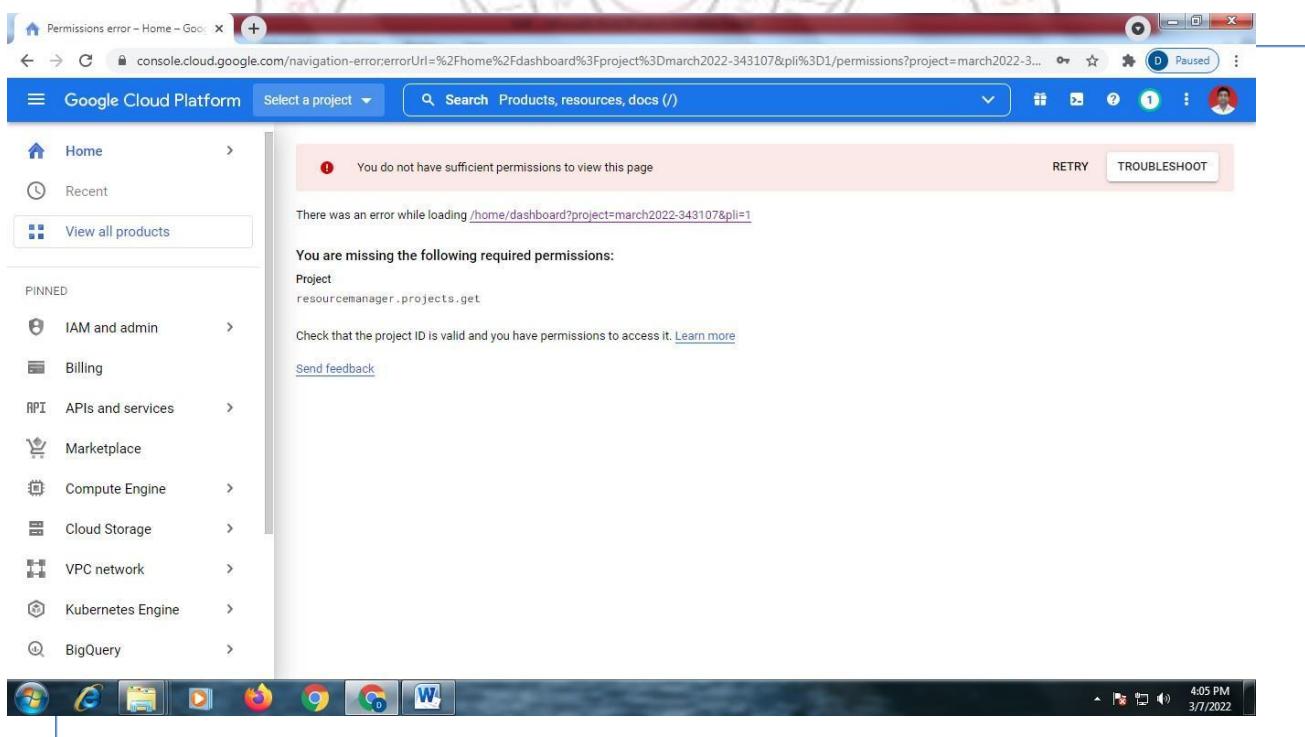
Steps □

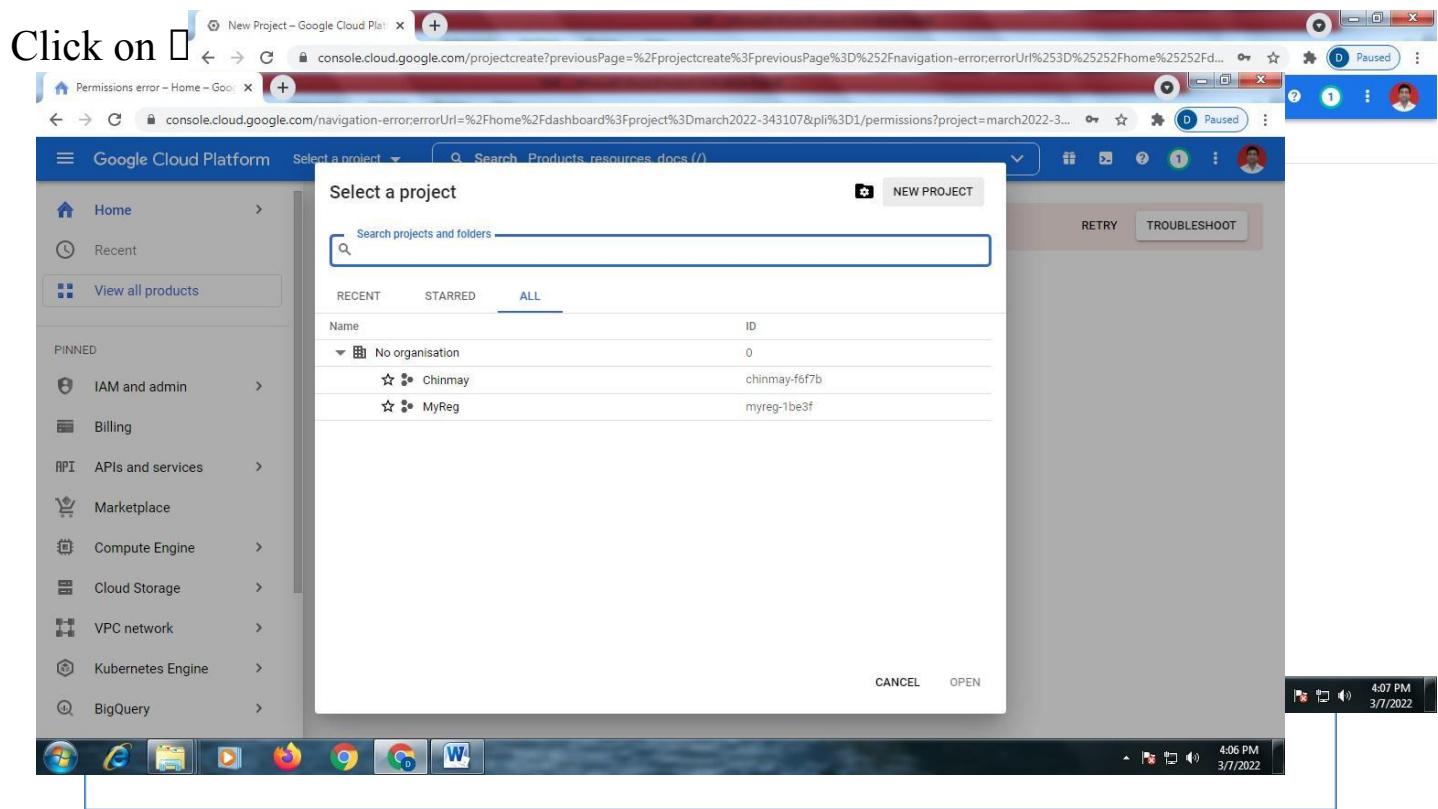


Following Screen Will Appear



Click on Select new project

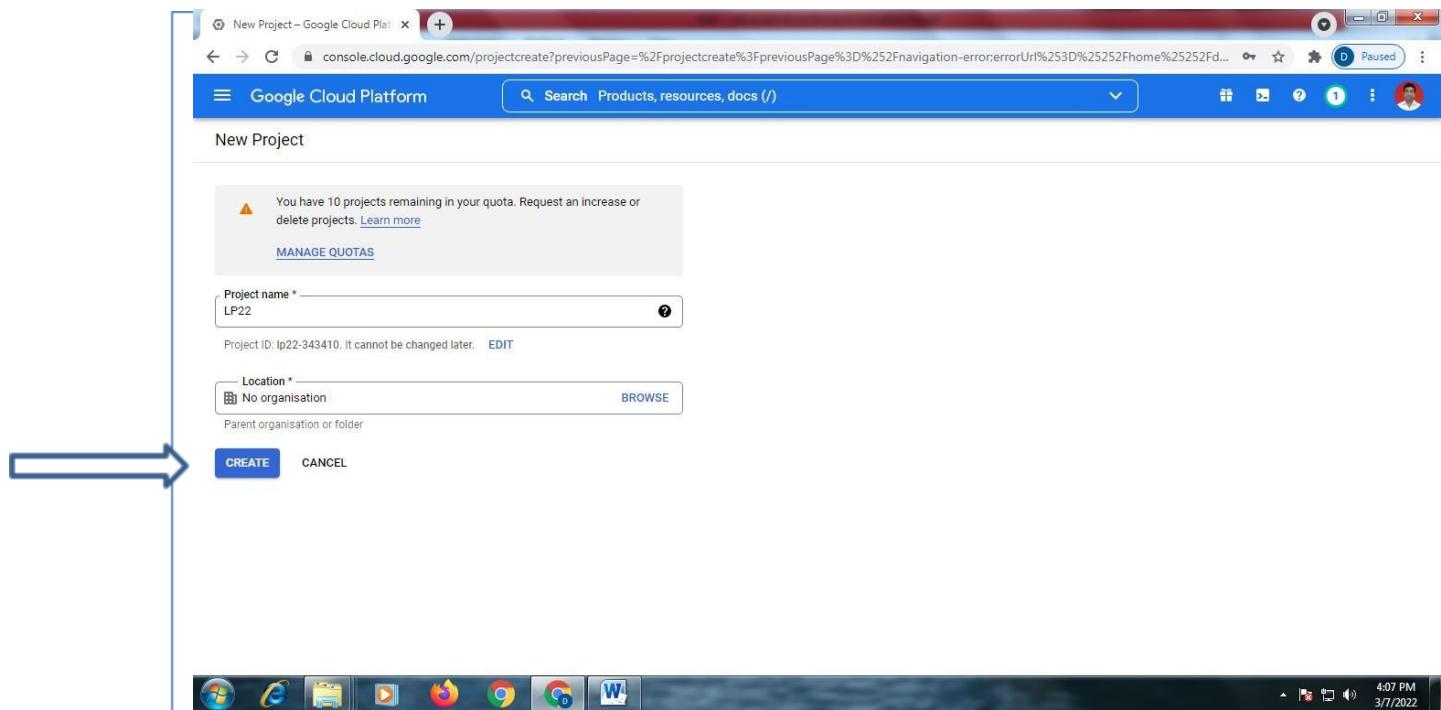




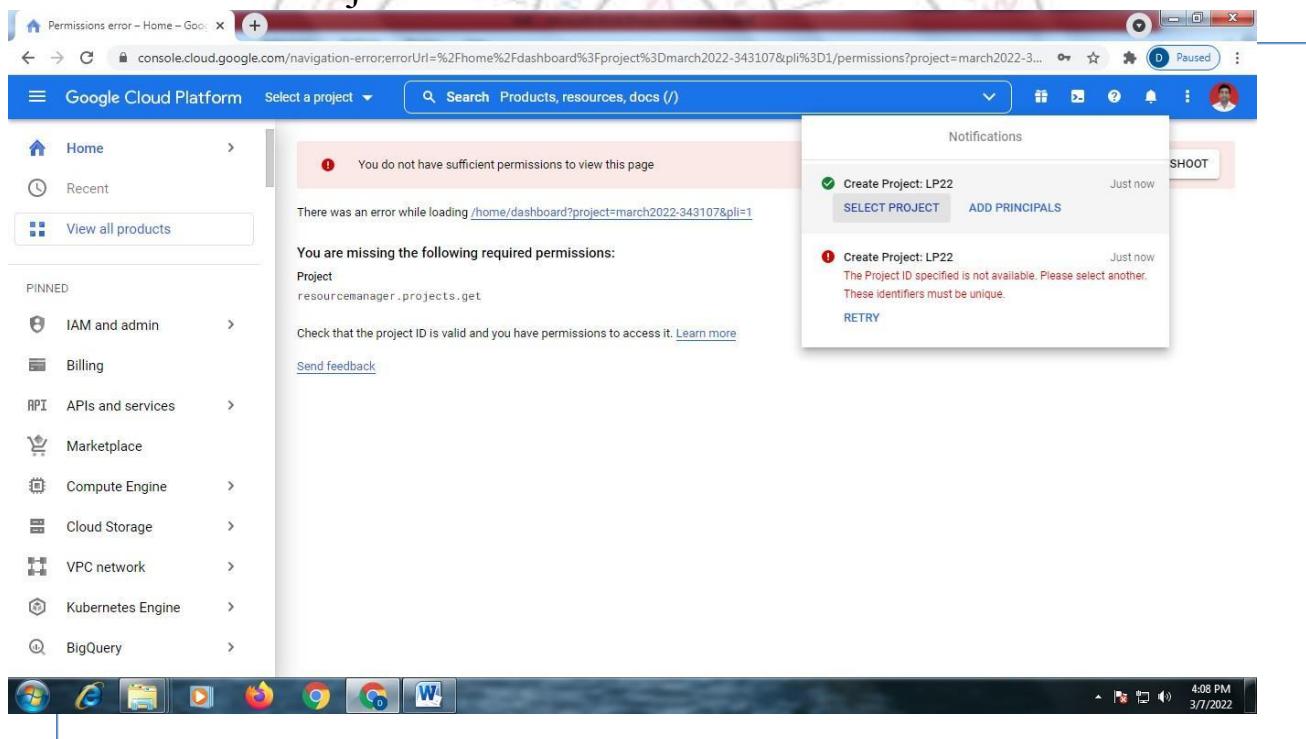
Give project name

A large rectangular input field occupies the central area of the screen, intended for entering a project name. A thick blue arrow points from the left towards the top-left corner of this input field, indicating where the user should click.

Click on create



Click on Select Project

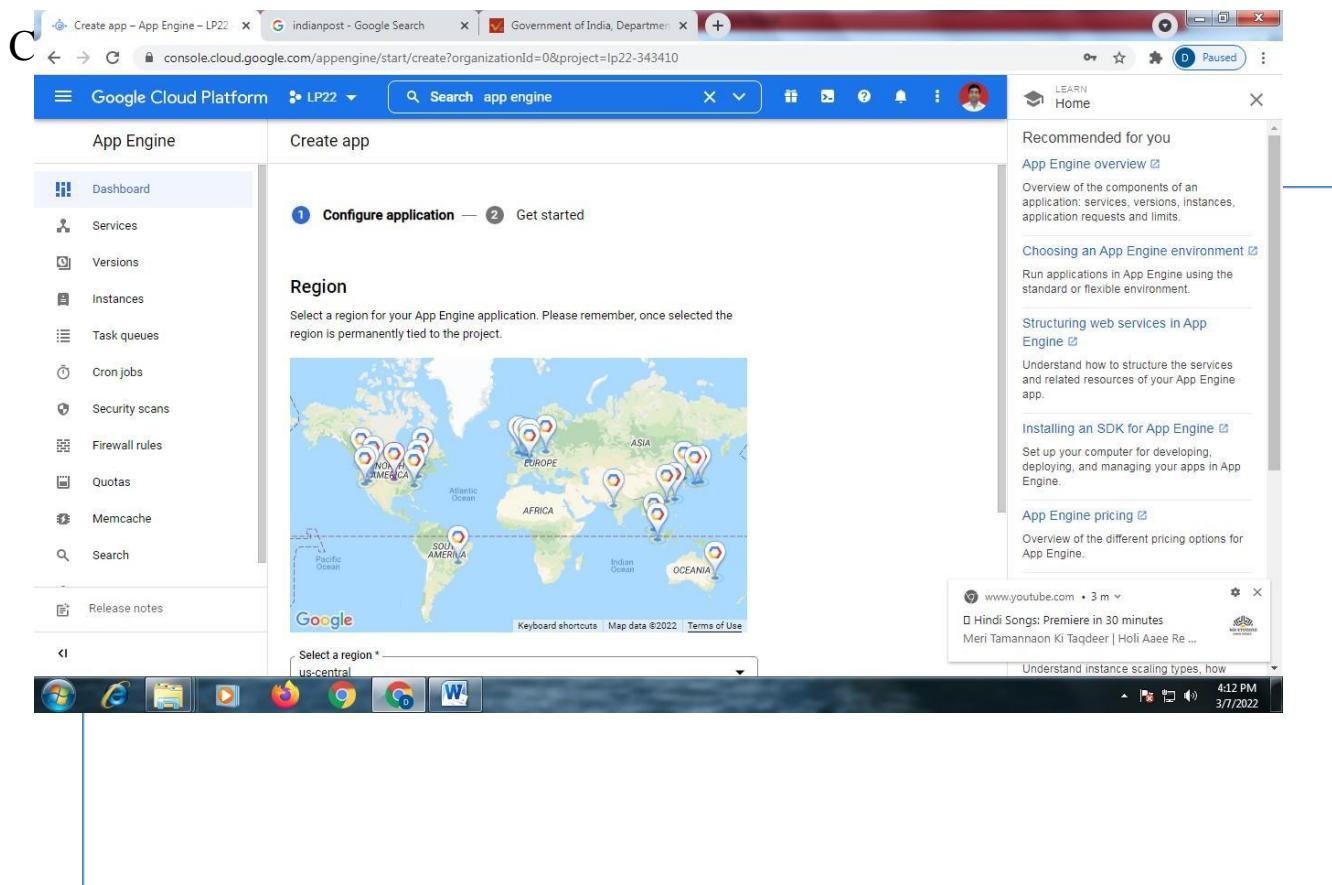


In search type —App Engine|

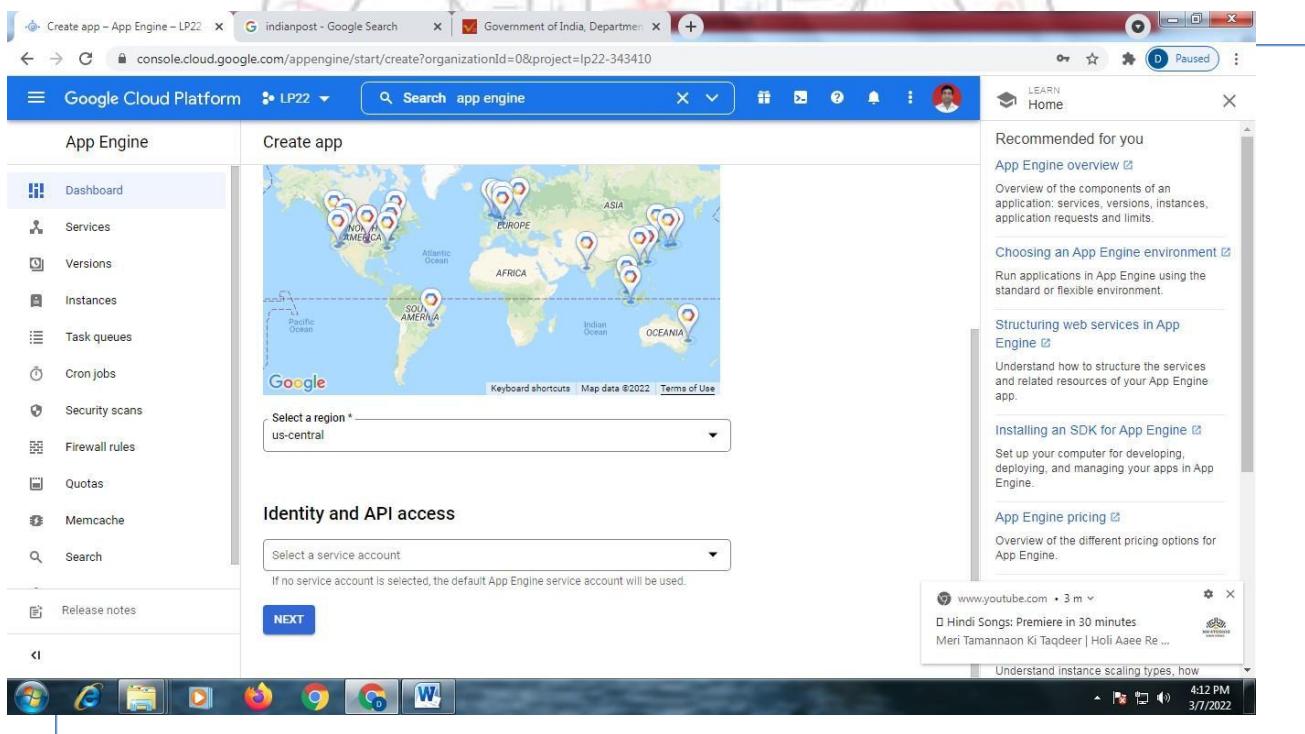
The screenshot shows the Google Cloud Platform dashboard for project LP22. A search bar at the top contains the text "app engine". Below the search bar, there is a sidebar with various project and service links. The main content area displays a search results page for "app engine", listing items like "App Engine", "Compute Engine", and "Application settings". On the right side, there is a sidebar titled "Google Cloud Platform status" which shows "ces normal" and a link to the "Cloud status dashboard". A YouTube video player in the bottom right corner shows a video about Hindi songs.

Click on ——App Engine| Following screen will appear

The screenshot shows the App Engine dashboard for project LP22. A search bar at the top contains the text "app engine". The left sidebar lists various management options: Dashboard, Services, Versions, Instances, Task queues, Cron jobs, Security scans, Firewall rules, Quotas, Memcache, Search, and Release notes. The main content area displays a "Welcome to App Engine" message with the subtext "Build scalable apps in any language on Google's infrastructure" and a "CREATE APPLICATION" button. A YouTube video player in the bottom right corner shows a video about Hindi songs.

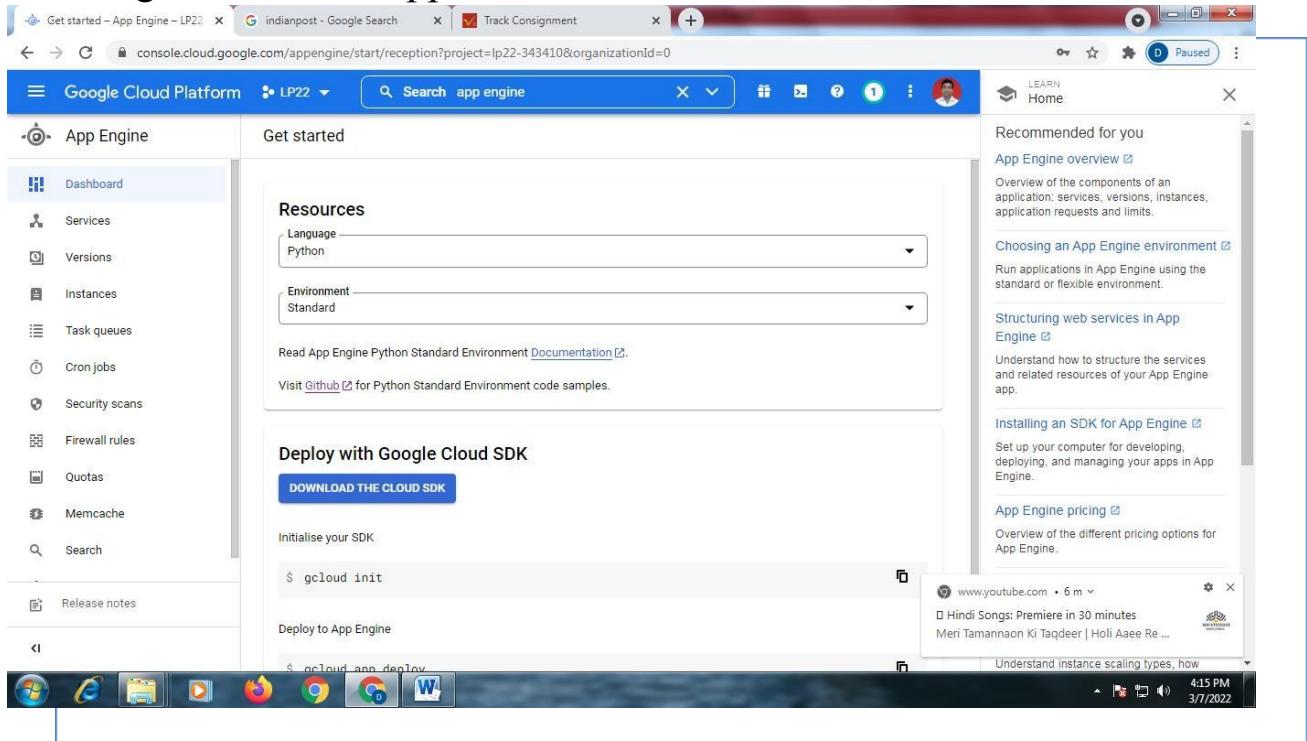


Scroll Down

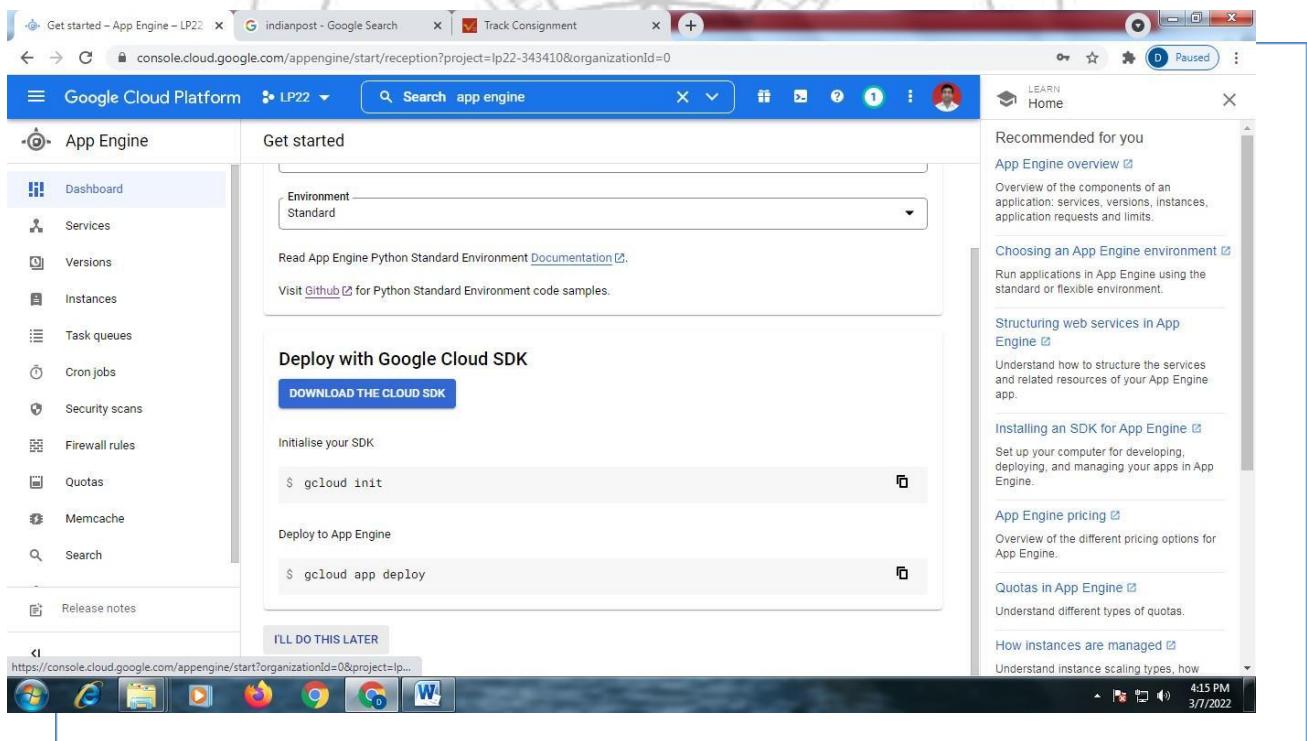


Click on —Next||

Following Screen Will Appear



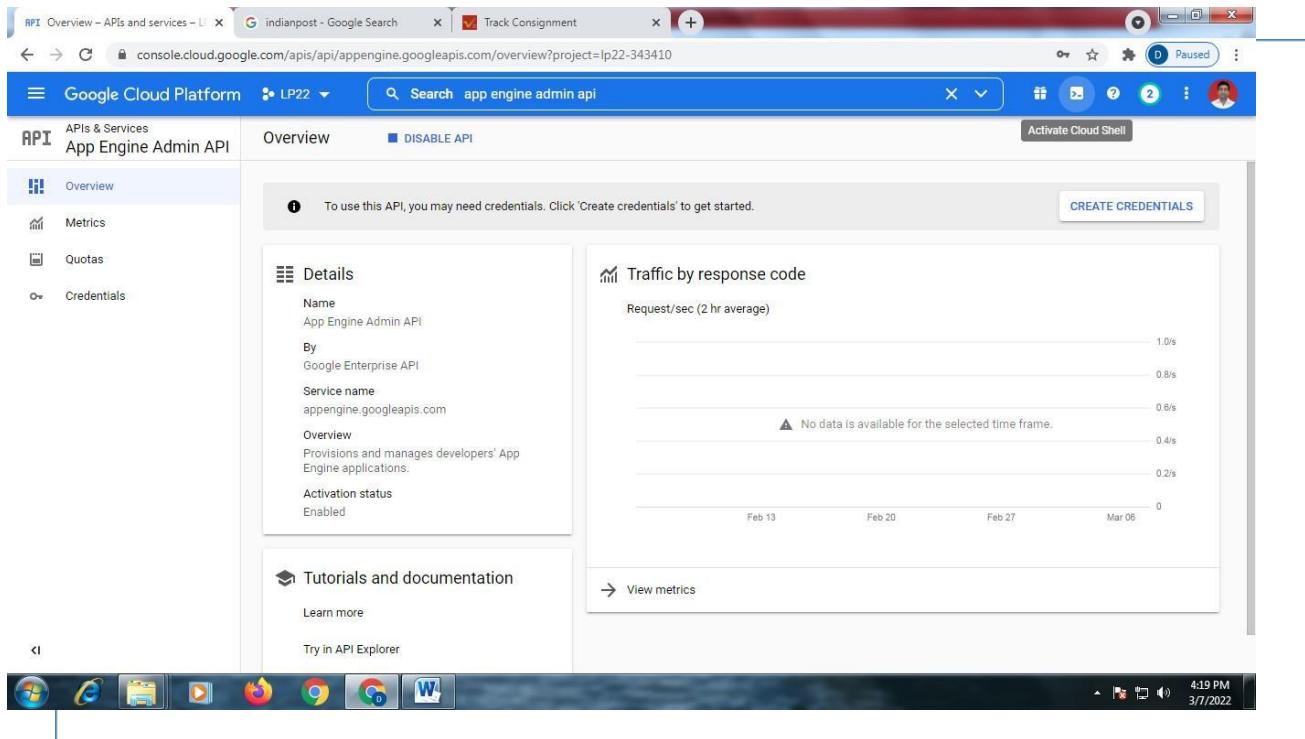
Scroll Down Click on ——I will do it Later||



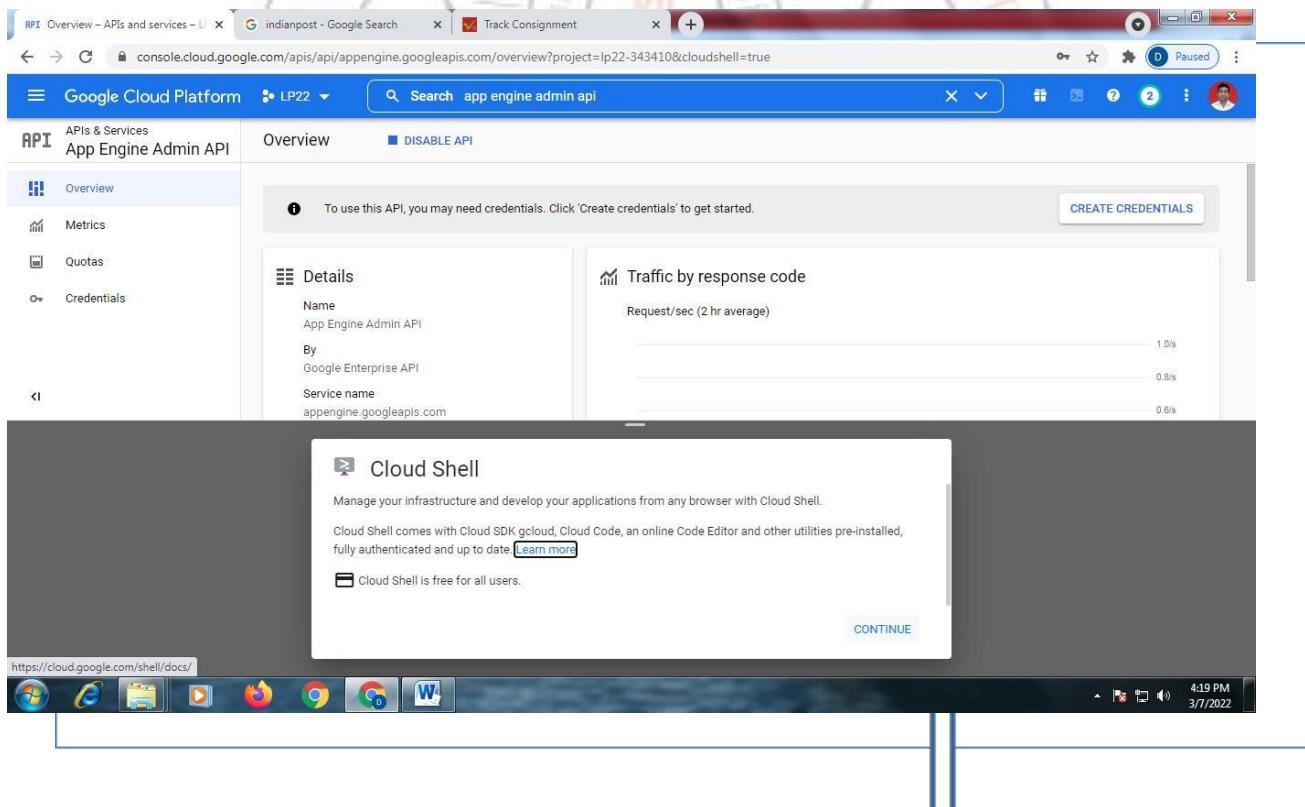
In search box, type —App Engine Admin API||

Click on ||App Engine Admin API|| Click on —Enable||

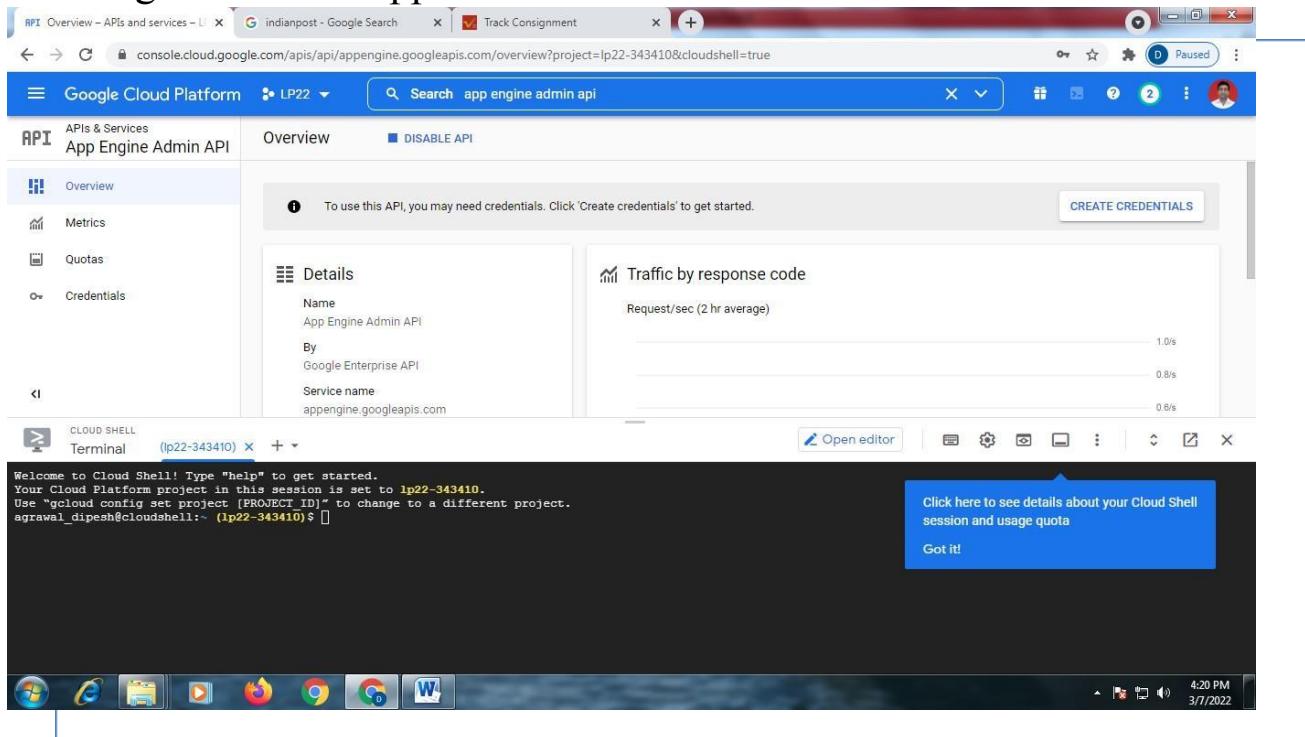
Click on —Activate Cloud Shell||



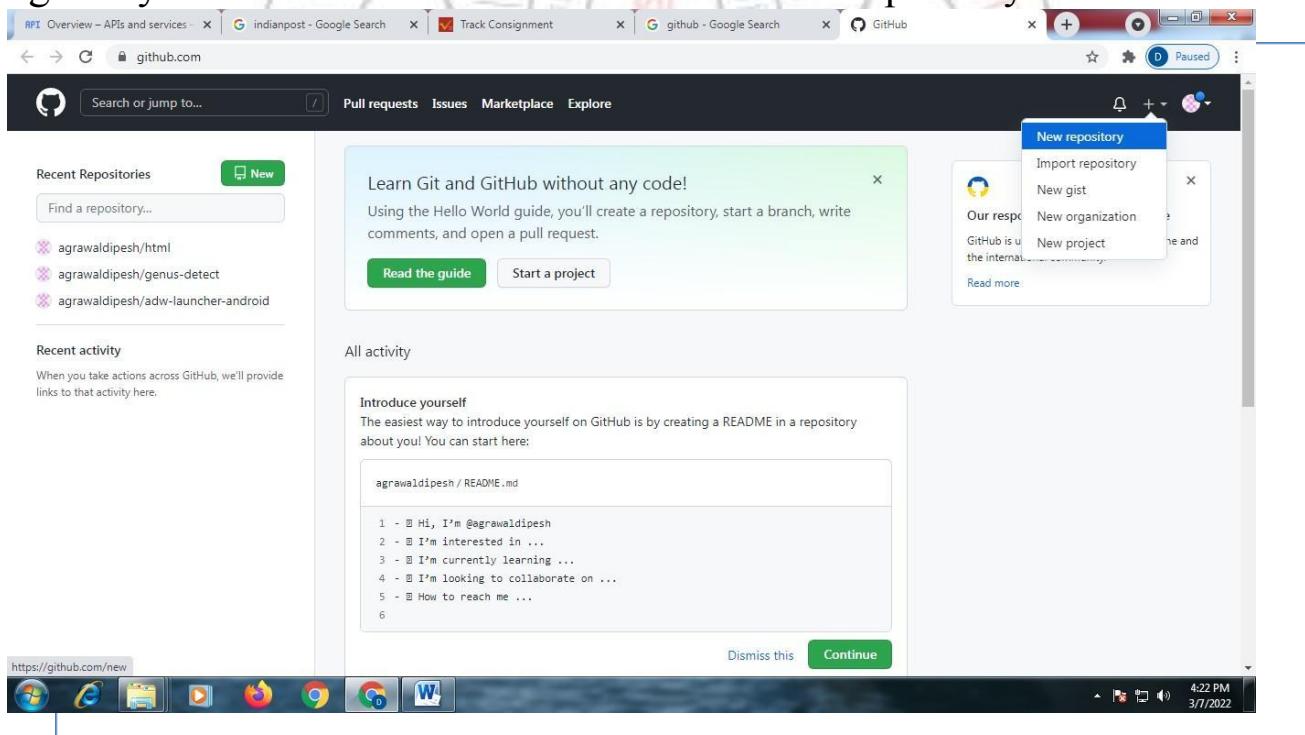
Click on —Continue||



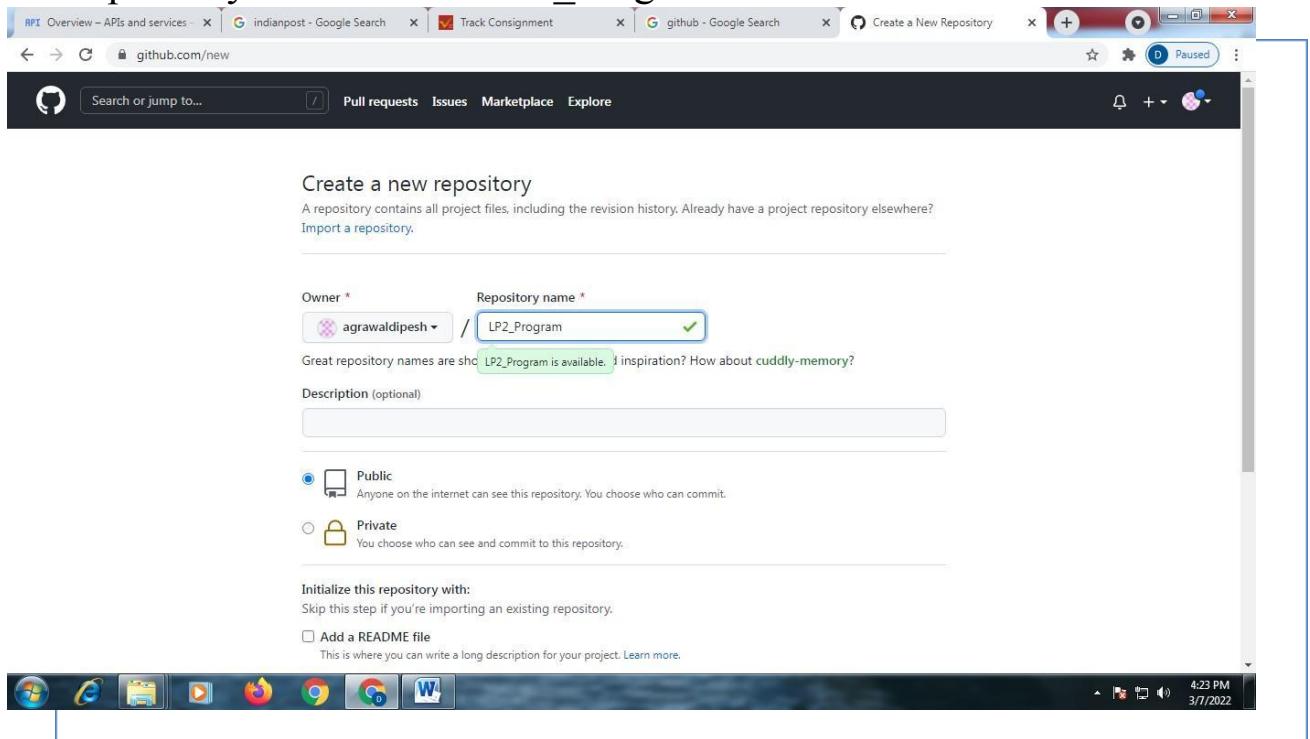
Following Screen will appear



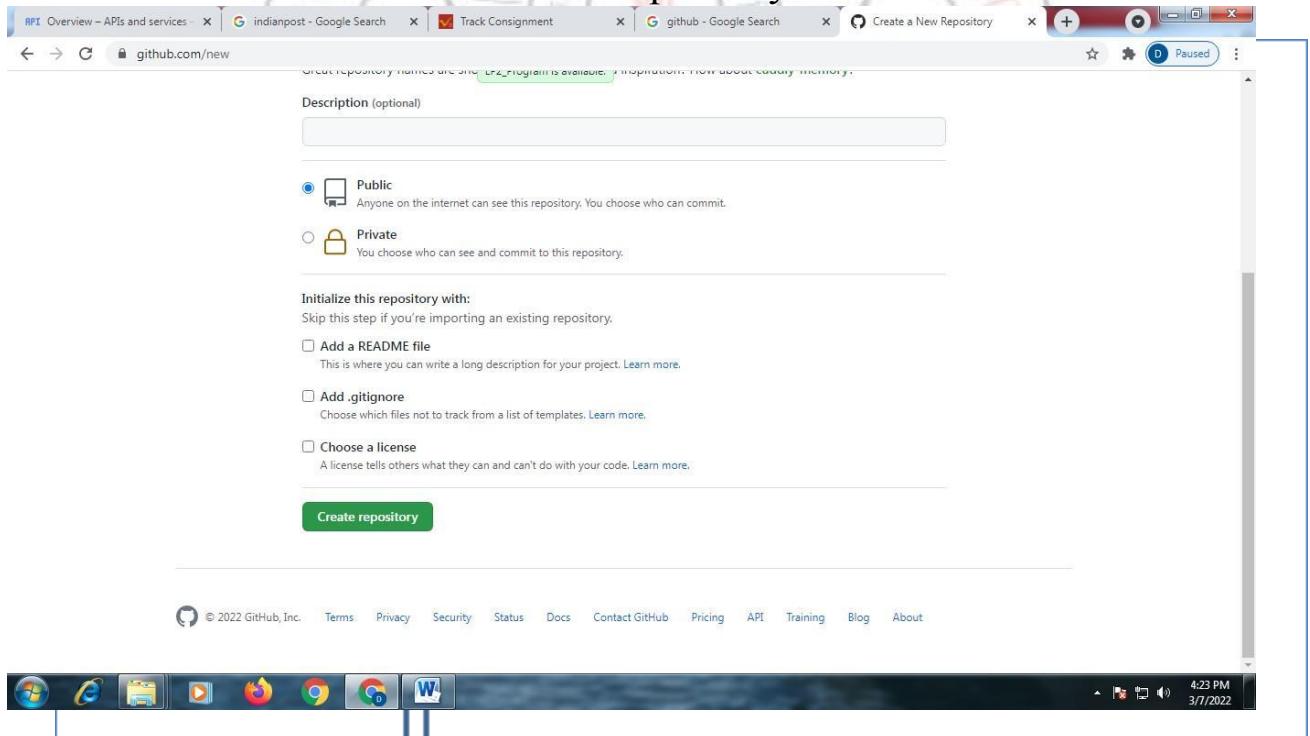
Login to your Github Account □ Click on —New Repository||



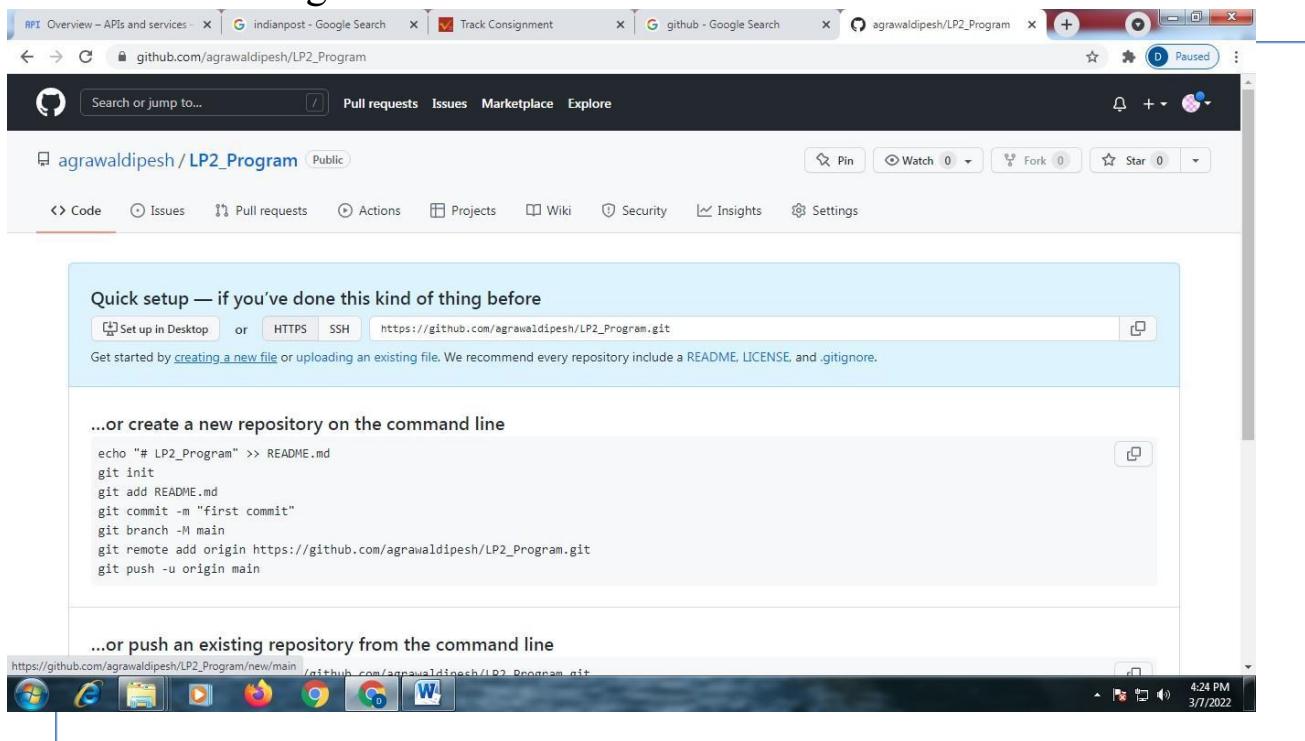
Give repository name as —LP2_Program||



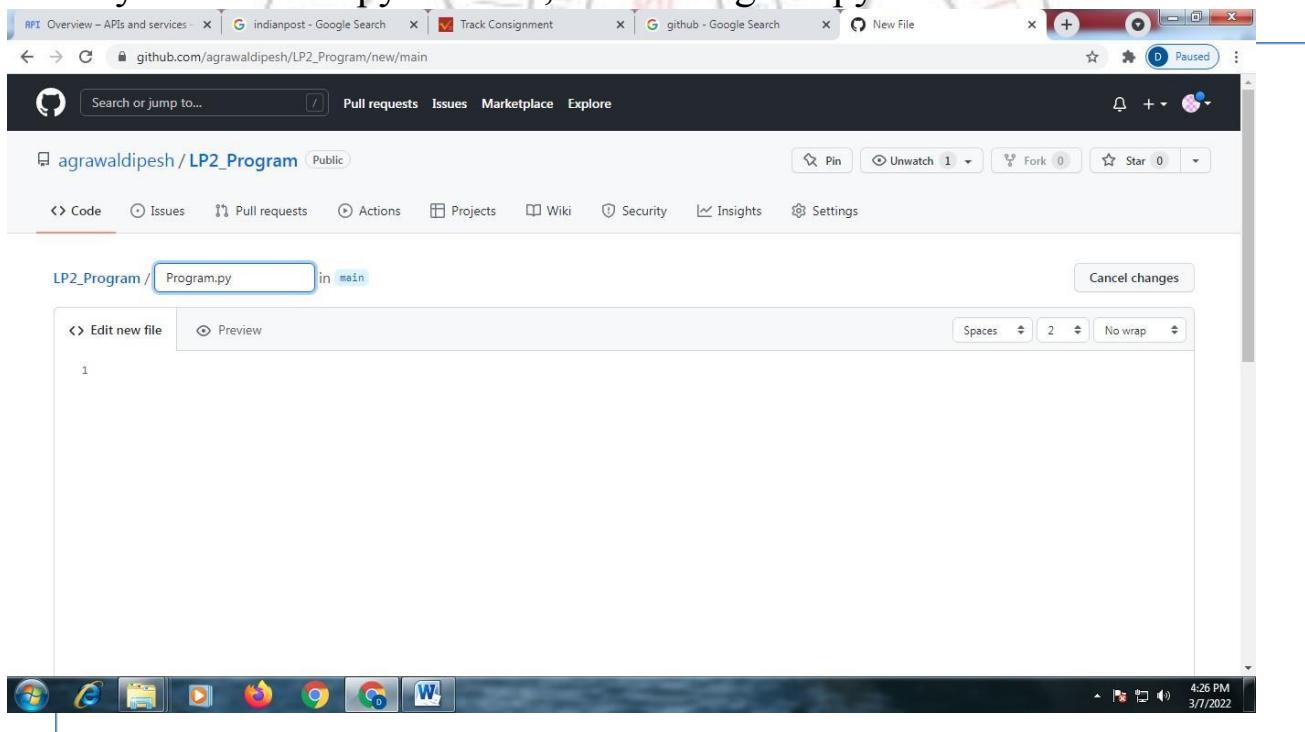
Scroll Down and Click on —Create Repository||



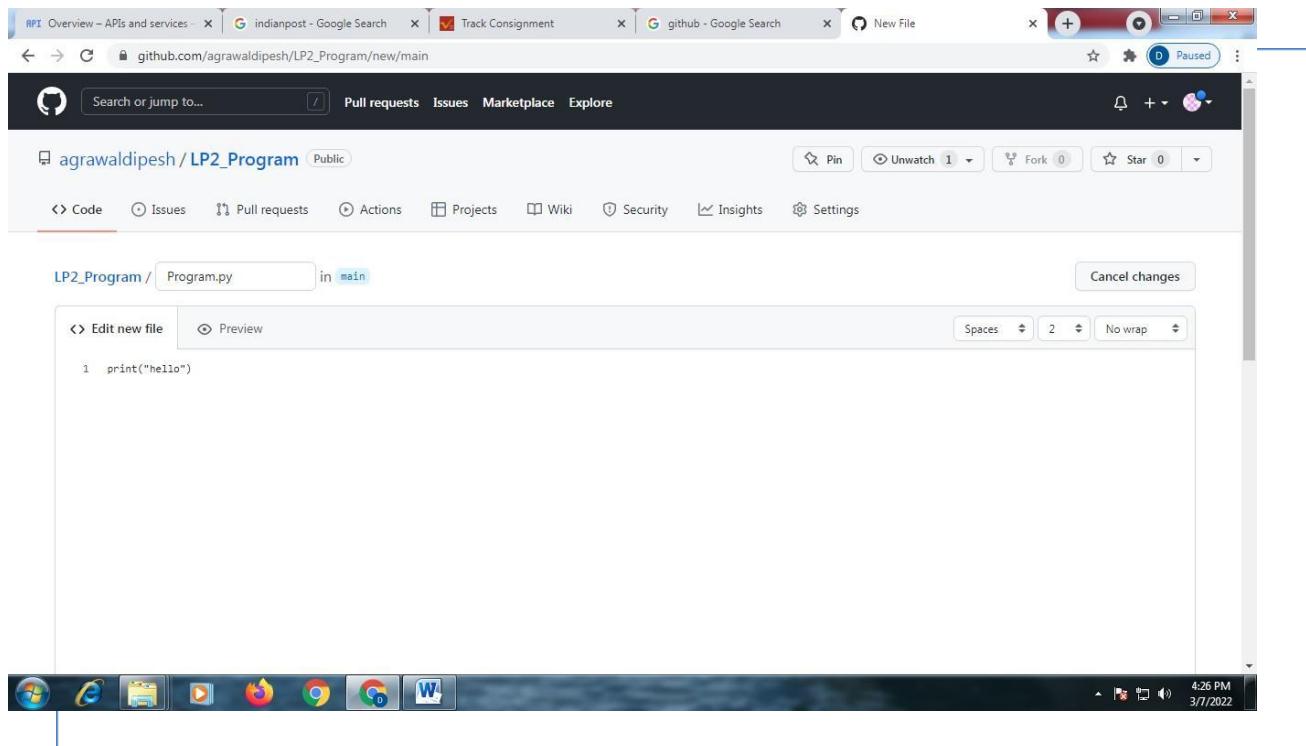
Click on —Creating a new File



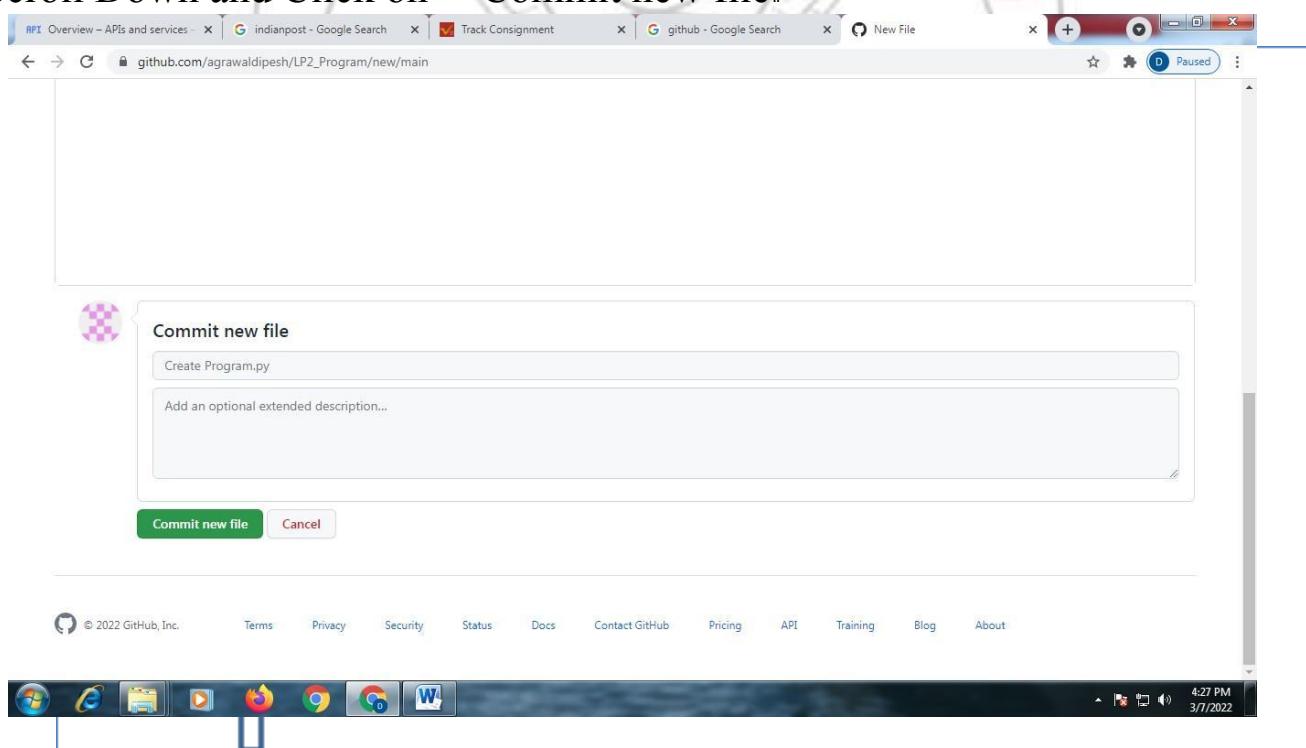
Give any name to the python file, like Program.py



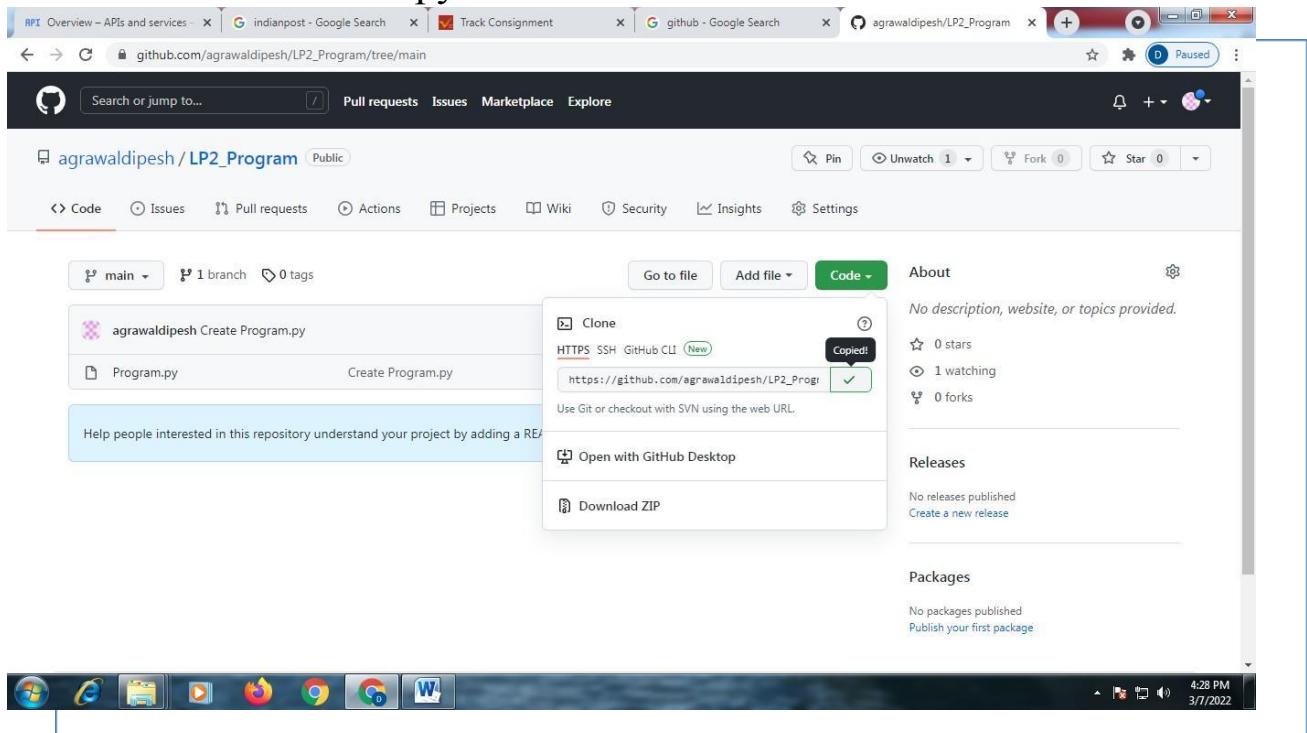
Type your code □ Print(—hello□)



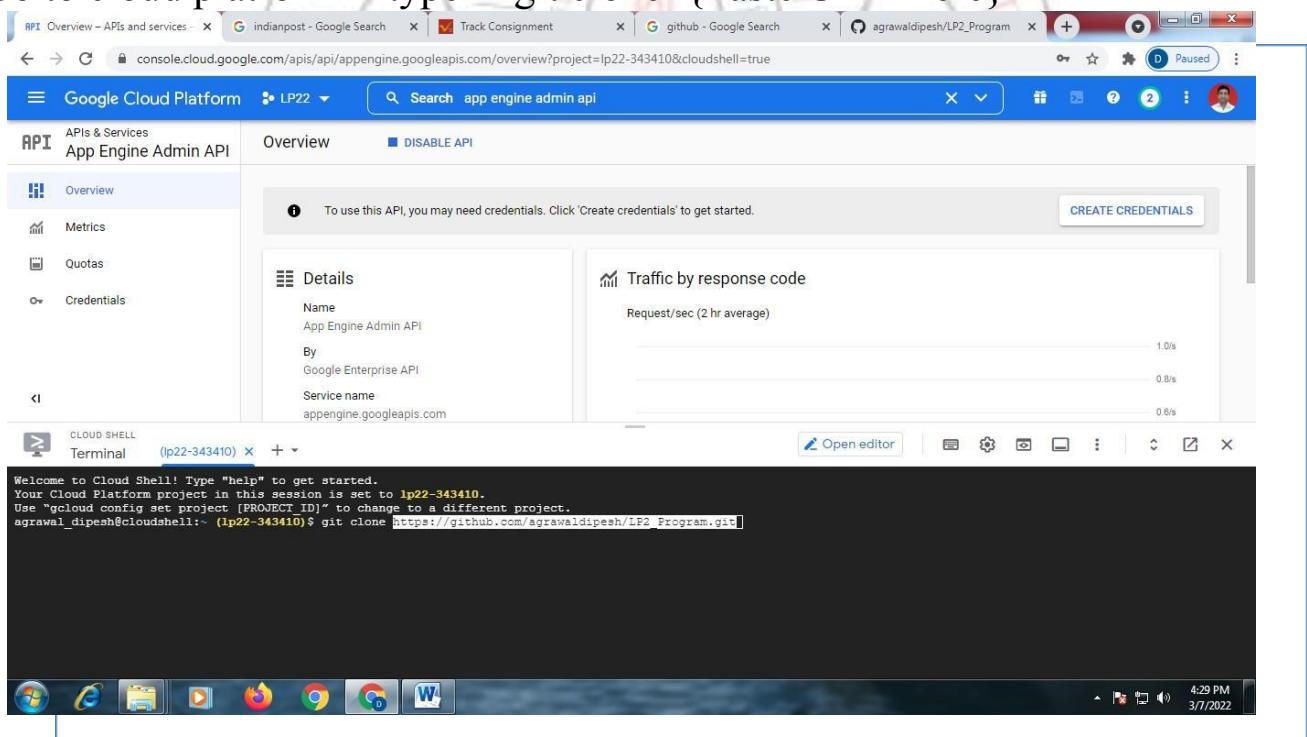
Scroll Down and Click on —Commit new file



Click on —Code|| and Copy URL {



Go to cloud platform { type —git clone|| {Paste URL Here} }



Type —ls||

To use this API, you may need credentials. Click 'Create credentials' to get started.

Details

- Name: App Engine Admin API
- By: Google Enterprise API
- Service name: appengine.googleapis.com

Traffic by response code

Request/sec (2 hr average)
1.0/s
0.8/s
0.6/s

CLOUD SHELL Terminal (lp22-343410) +

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to lp22-343410.
Use "gcloud config set project [PROJECT ID]" to change to a different project.
agrwal_dipesh@cloudshell:~ (lp22-343410)$ git clone https://github.com/agrawaldipesh/LP2_Program.git
Cloning into 'LP2_Program'...
remote: Enumerating objects: 3, done.
remote: Counting objects: 100% (3/3), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Receiving objects: 100% (3/3), done.
agrwal_dipesh@cloudshell:~ (lp22-343410)$ ls
LP2_Program README-cloudshell.txt
agrwal_dipesh@cloudshell:~ (lp22-343410)$
```

4:31 PM 3/7/2022

Enter into repository, using command — cd repository name (here it is – LP2_Program) — ls

To use this API, you may need credentials. Click 'Create credentials' to get started.

Details

- Name: App Engine Admin API
- By: Google Enterprise API
- Service name: appengine.googleapis.com

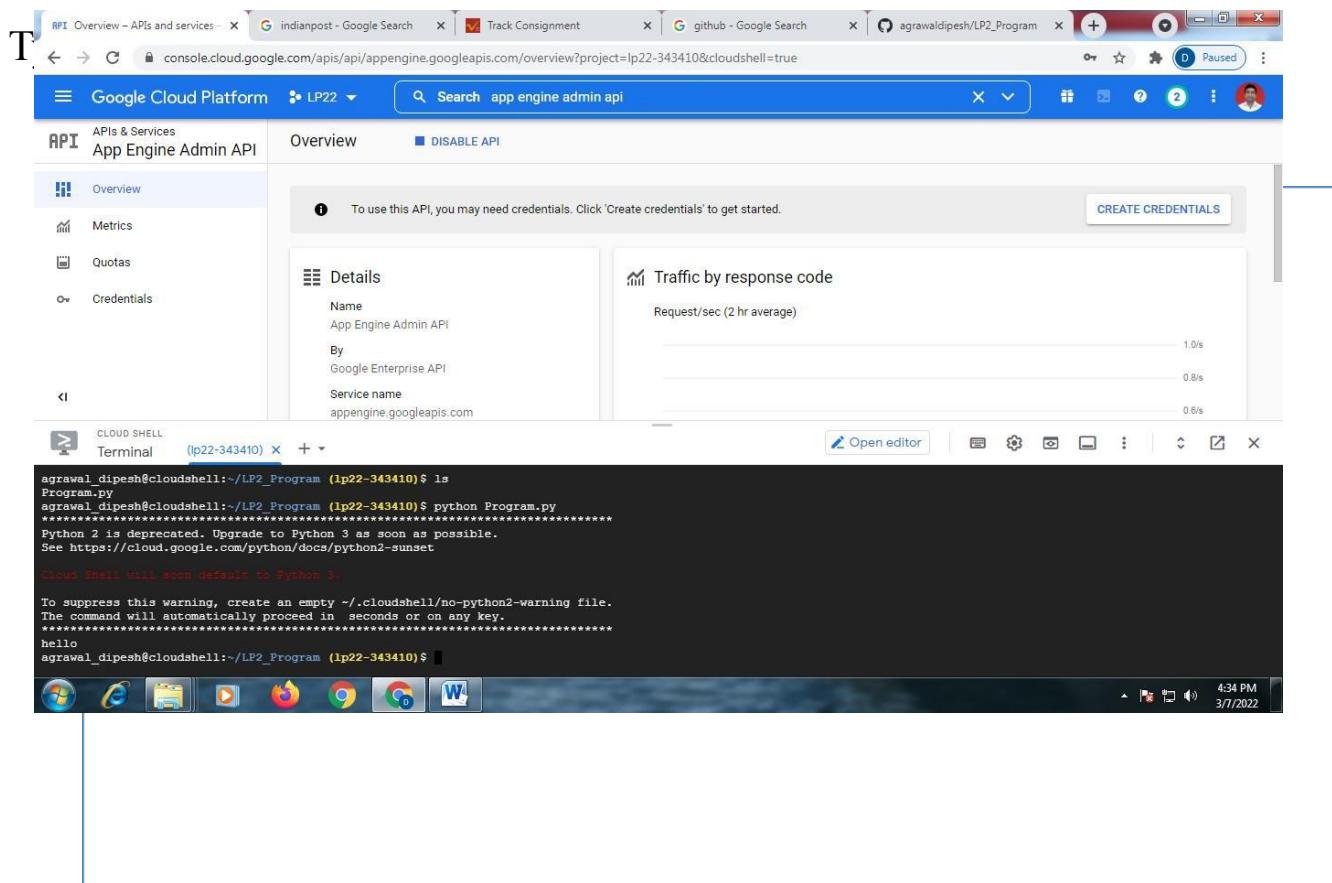
Traffic by response code

Request/sec (2 hr average)
1.0/s
0.8/s
0.6/s

CLOUD SHELL Terminal (lp22-343410) +

```
Your Cloud Platform project in this session is set to lp22-343410.
Use "gcloud config set project [PROJECT ID]" to change to a different project.
agrwal_dipesh@cloudshell:~ (lp22-343410)$ git clone https://github.com/agrawaldipesh/LP2_Program.git
Cloning into 'LP2_Program'...
remote: Enumerating objects: 3, done.
remote: Counting objects: 100% (3/3), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Receiving objects: 100% (3/3), done.
agrwal_dipesh@cloudshell:~ (lp22-343410)$ ls
LP2_Program README-cloudshell.txt
agrwal_dipesh@cloudshell:~ (lp22-343410)$ cd LP2_Program
agrwal_dipesh@cloudshell:/LP2_Program (lp22-343410)$ ls
Program.py
agrwal_dipesh@cloudshell:/LP2_Program (lp22-343410)$
```

4:32 PM 3/7/2022



6.Frequently Asked Questions:

1. What is Google App Engine ?
2. What is difference between SQL and GQL ?
3. What are the advantages of Google App Engine over Amazon EC2 ?
4. What is Kubernetes ?
5. What is AppScale ?

7.Conclusion:

Successfully Installation and configure Google App Engine

SNJB's Late Sau. K. B. Jain College of Engineering, Chandwad

Department of Computer Engineering

Course Name:Laboratory Practice II(310258):Cloud Computing

Class:Third Year (TE) Div A/ Div B

Batch:T1/T2/T3/T4

Name:

Roll No:

Assignment No: 9

Answers (A) – 5M	Coding Efficiency (C) – 5M	Viva (V) – 5M	Timely Completion (T) – 5M	Total(20M)	Sign

Date of Performance:..... **Date of Completion:**.....

1. Title of Assignment:

Creating an Application in SalesForce.com using Apex programming Language.

2. Objective:

1. To learn the salesforce environment.
2. Create a small application using APEX programming language.

3. Outcome: Use tools and techniques in the area of Cloud Computing

4. Software and Hardware Requirement:

Software Requirement: login required for SalesForce.com

Hardware Requirement: Internet Connection, PC with Min. 2GB RAM, Core i5 Processor

5.Relevant Theory :

What is Salesforce?

Salesforce is the world's #1 cloud-based customer relationship management (CRM) platform. It is an integrated CRM platform that provides a single shared view of each customer for all the departments within an organization, such as Marketing, Sales, Commerce, and Service. Our salesforce tutorial is designed to help beginners with the Salesforce and professionals' basic concepts with advanced concepts. In this, we will cover all the essential topics of Salesforce from beginning to Apex development.

What does Salesforce do?

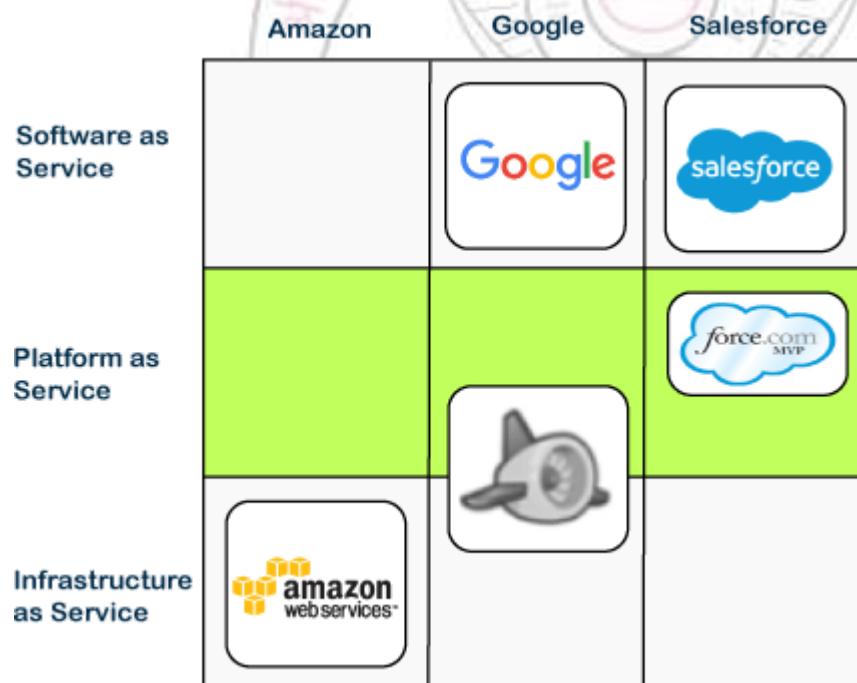
Salesforce bring companies and customers together. Salesforce unites your marketing, sales, commerce, service, and IT teams from anywhere with Customer 360 — one integrated CRM platform that powers our entire suite of connected apps. With Customer 360, you can focus your employees on what's important right now: stabilizing your business, reopening, and getting back to delivering exceptional customer experiences.

What is Salesforce used for?

1. Attract more buyers using personalized marketing.
2. Win more customers by getting to know their needs and concerns.
3. Deliver the amazing shopping experiences your customers expect.
4. Respond faster to customer support issues on any channel.
5. Automate time-consuming tasks by building custom apps.

Over 150,000 companies, both big and small, are growing their business with Salesforce.

- o Salesforce is a SaaS or Software as a Service, which means there is no need to install the software or server to work on. Users can simply sign-up in Salesforce.com and can start running the business instantly.



- o It was founded by Marc Benioff, Parker Harris, Dave Moellenhoff, and Frank Dominguez in 1999.
- o Salesforce was started as a CRM software, but today it provides various products and software solutions to users and developers.
- o Since Salesforce is cloud-based software, hence it does not require any IT

professional to set up anything. It provides one of the best ways to connect with customers, business partners, and clients over the single integrated environment. It allows the businesses to identify the customer's requirements, address the problems easily, and provide the same solution in the minimum timeframe.

Companies using Salesforce

Today, there are multiple big brands, and new start-ups who are using the Salesforce platform as CRM software and for other services. Below is the list of some popular companies that are using Salesforce for their businesses:

1. HCL Technologies use Salesforce CRM for data entry to validate customer data.
2. Pizza Hut is providing the smart mobile experience to its customer using the marking salesforce cloud.
3. L'Oreal builds a social network using the Salesforce, by which they can share any Hair fashion-related plans or events to their stylist or customer.
4. American Express is using the Salesforce cloud since 2010, and now they can connect to their employees together across the organization, or from anywhere.
5. Nikon Instrument opted for the Salesforce CRM for their business, but later, they also started using the social network provided by the Chatter.
6. Comcast-Spectator uses the salesforce platform to manage the customer profiles that help them identify the customer interest and market more efficiently.
7. Sony uses the Salesforce Service Cloud to connect with their customers. All customer complaints are managed and taken care of with this to make the customers satisfied.

Other companies, such as Urban Ladder, InMobi, Paytm, Genesys, etc., use Salesforce services for their business growth.

What is Apex?

Apex is a proprietary language developed by the Salesforce.com. As per the official definition, Apex is a strongly typed, object-oriented programming language that allows developers to execute the flow and transaction control statements on the Force.com platform server in conjunction with calls to the Force.com API.

It has a Java-like syntax and acts like database stored procedures. It enables the developers to add business logic to most system events, including button clicks, related record updates, and Visualforce pages. Apex code can be initiated by Web service requests and from triggers on

objects. Apex is included in Performance Edition, Unlimited Edition, Enterprise Edition, and Developer Edition.

When Should Developer Choose Apex?

Apex should be used when we are not able to implement the complex business functionality using the pre-built and existing out of the box functionalities. Below are the cases where we need to use apex over Salesforce configuration.

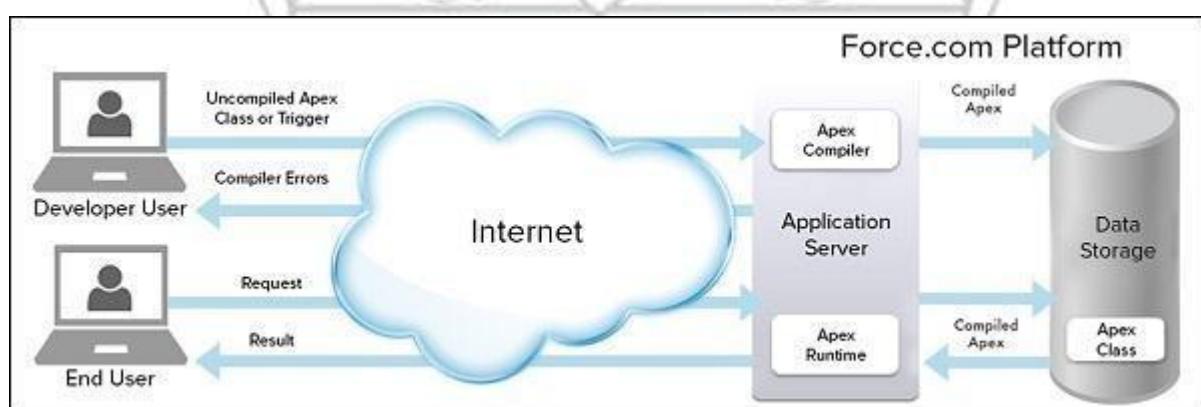
Apex Applications

We can use Apex when we want to –

- Create Web services with integrating other systems.
- Create email services for email blast or email setup.
- Perform complex validation over multiple objects at the same time and also custom validation implementation.
- Create complex business processes that are not supported by existing workflow functionality or flows.
- Create custom transactional logic (logic that occurs over the entire transaction, not just with a single record or object) like using the Database methods for updating the records.
- Perform some logic when a record is modified or modify the related object's record when there is some event which has caused the trigger to fire.

Working Structure of Apex

As shown in the diagram below (Reference: Salesforce Developer Documentation), Apex runs entirely on demand Force.com Platform



Flow of Actions

There are two sequence of actions when the developer saves the code and when an end user performs some action which invokes the Apex code as shown below –

Developer Action

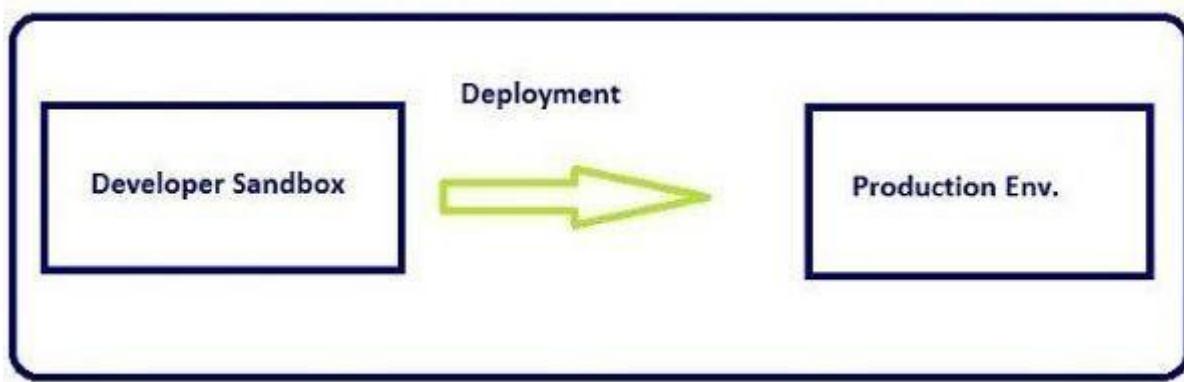
When a developer writes and saves Apex code to the platform, the platform application server first compiles the code into a set of instructions that can be understood by the Apex runtime interpreter, and then saves those instructions as metadata.

End User Action

When an end-user triggers the execution of Apex, by clicking a button or accessing a Visualforce page, the platform application server retrieves the compiled instructions from the metadata and sends them through the runtime interpreter before returning the result. The end-user observes no differences in execution time as compared to the standard application platform request.

Since Apex is the proprietary language of Salesforce.com, it does not support some features which a general programming language does. Following are a few features which Apex does not support –

- It cannot show the elements in User Interface.
- You cannot change the standard SFDC provided functionality and also it is not possible to prevent the standard functionality execution.
- Creating multiple threads is also not possible as we can do it in other languages.
- You can develop the Apex code in either Sandbox or Developer edition of Salesforce. A Sandbox organization is a copy of your organization in which you can write code and test it without taking the risk of data modification or disturbing the normal functionality. As per the standard industrial practice, you have to develop the code in Sandbox and then deploy it to the Production environment.
- For this tutorial, we will be using the Developer edition of Salesforce. In the Developer edition, you will not have the option of creating a Sandbox organization. The Sandbox features are available in other editions of Salesforce.



Apex Code Development Tools

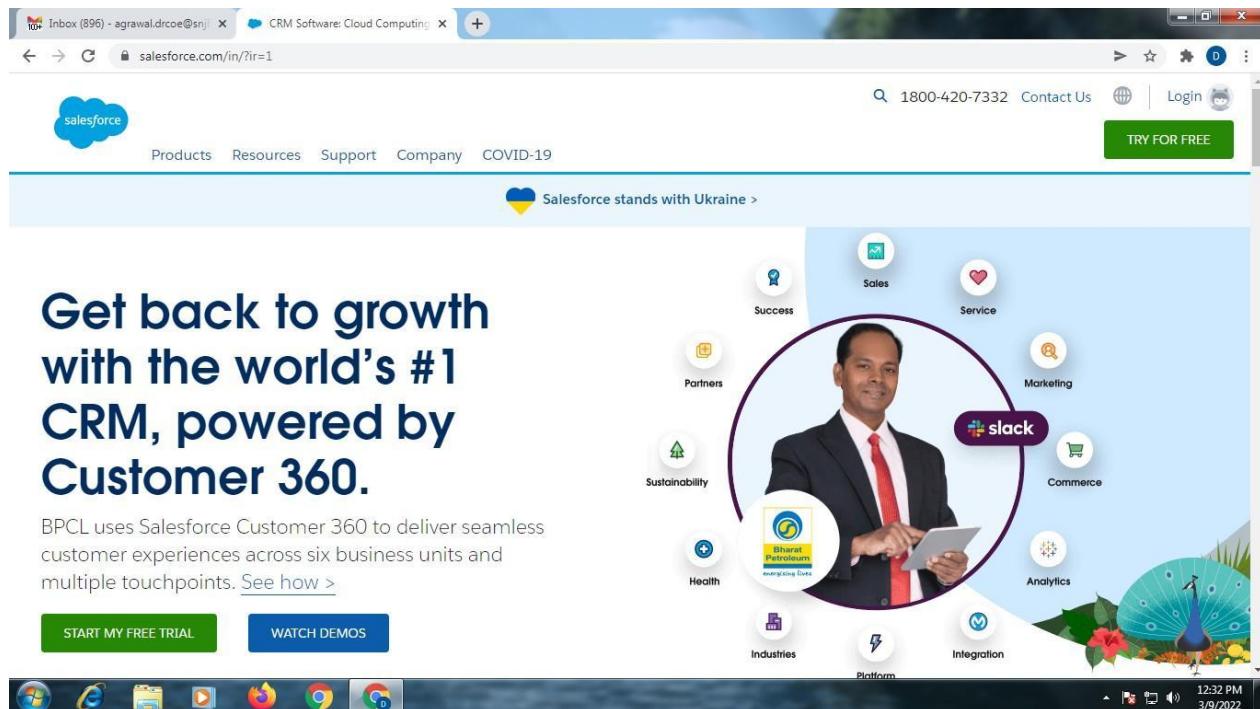
In all the editions, we can use any of the following three tools to develop the code –

- Force.com Developer Console
- Force.com IDE
- Code Editor in the Salesforce User Interface

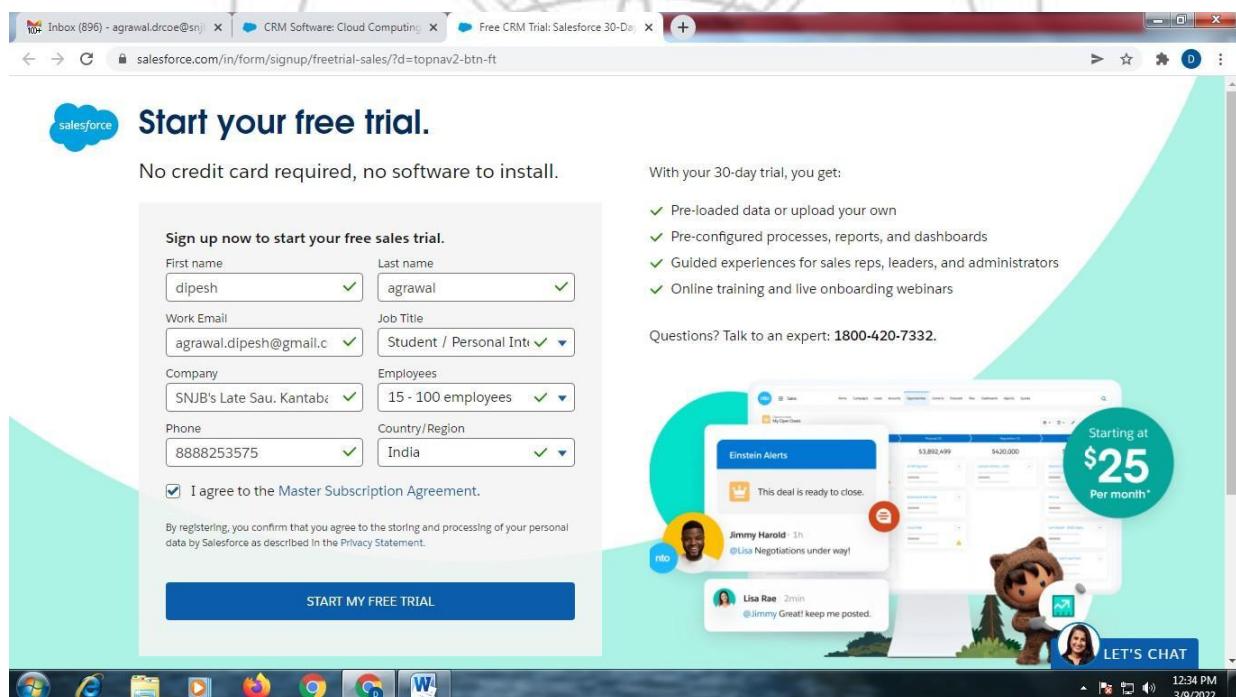
Note – We will be utilizing the Developer Console throughout our tutorial for code execution as it is simple and user friendly for learning.

Steps –

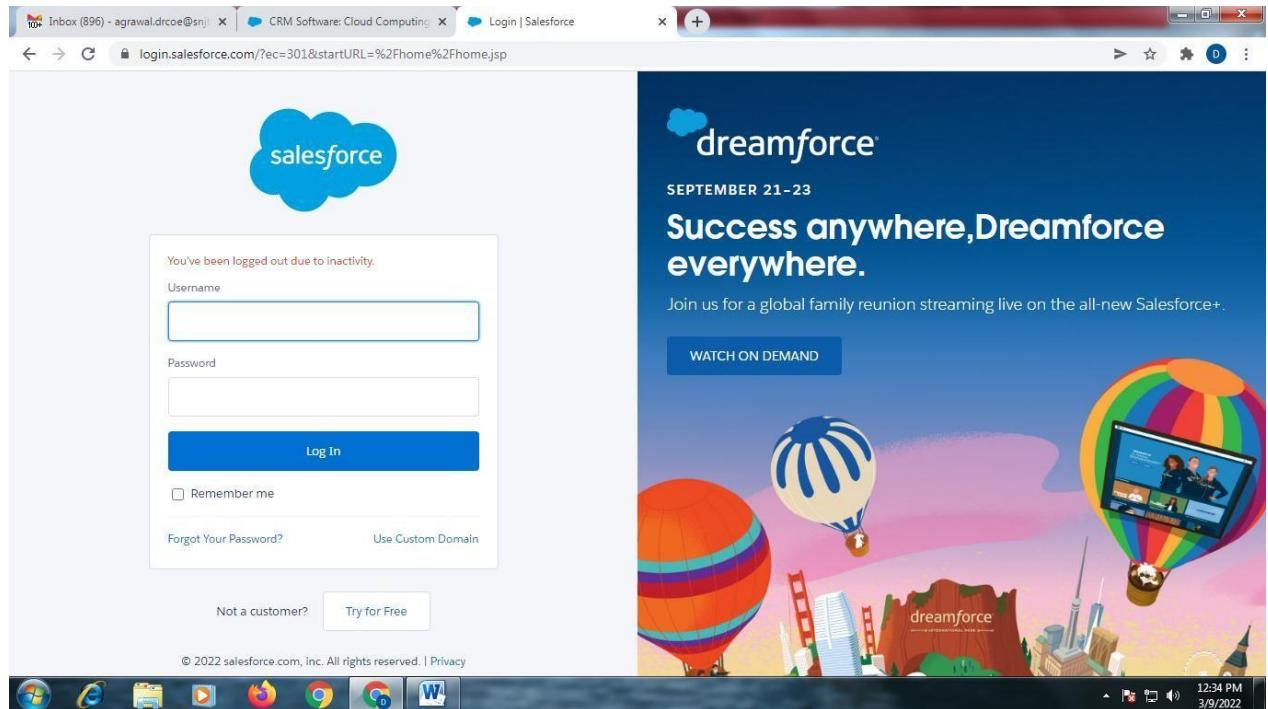
Open www.salesforce.com website in browser.



Create Your Account ?



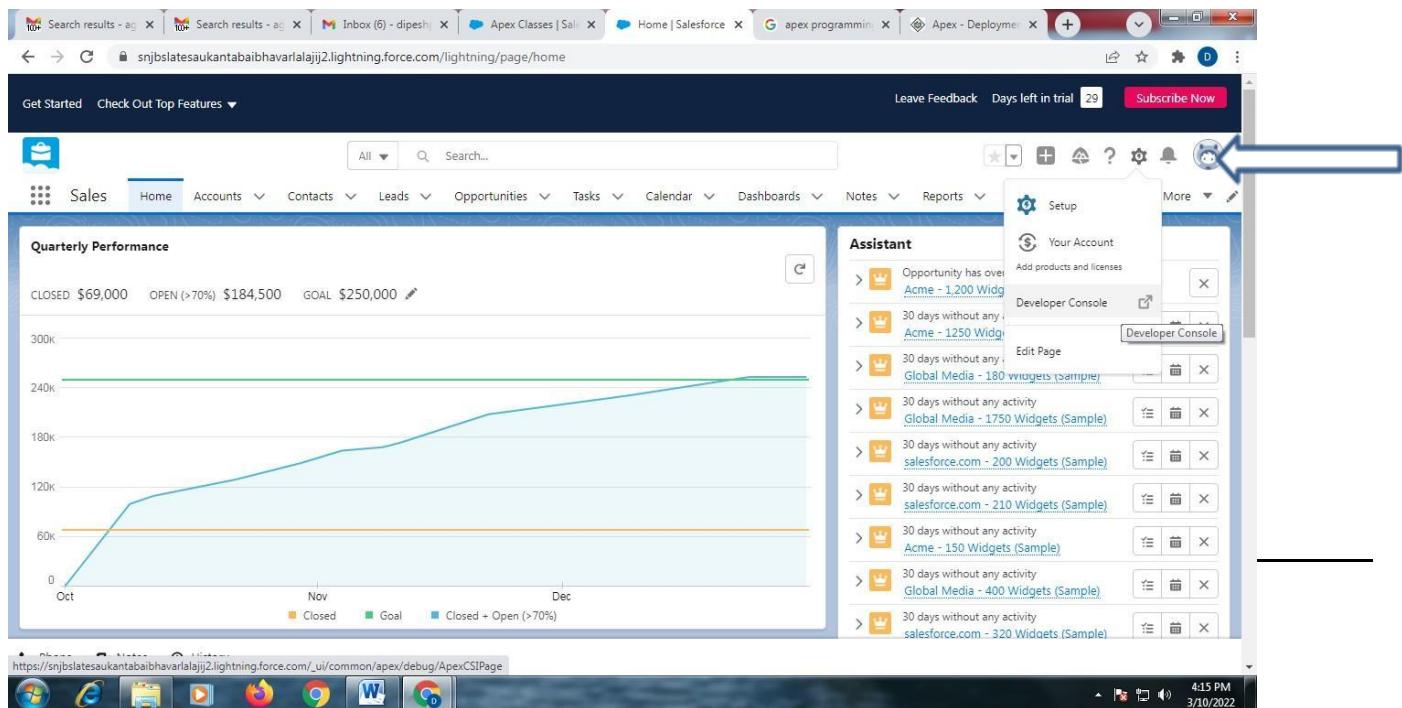
Enter Login-id and Password



Following Screen will appear



Click on “Setup”

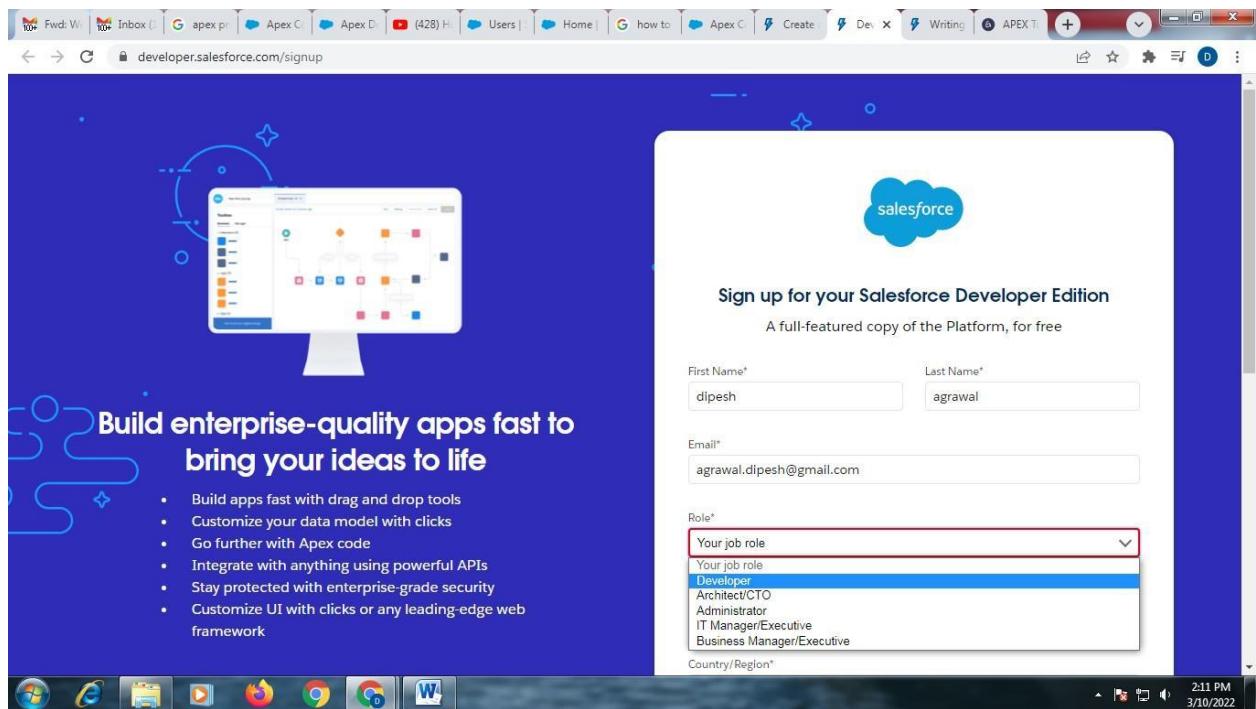


Click on “Developer Console”

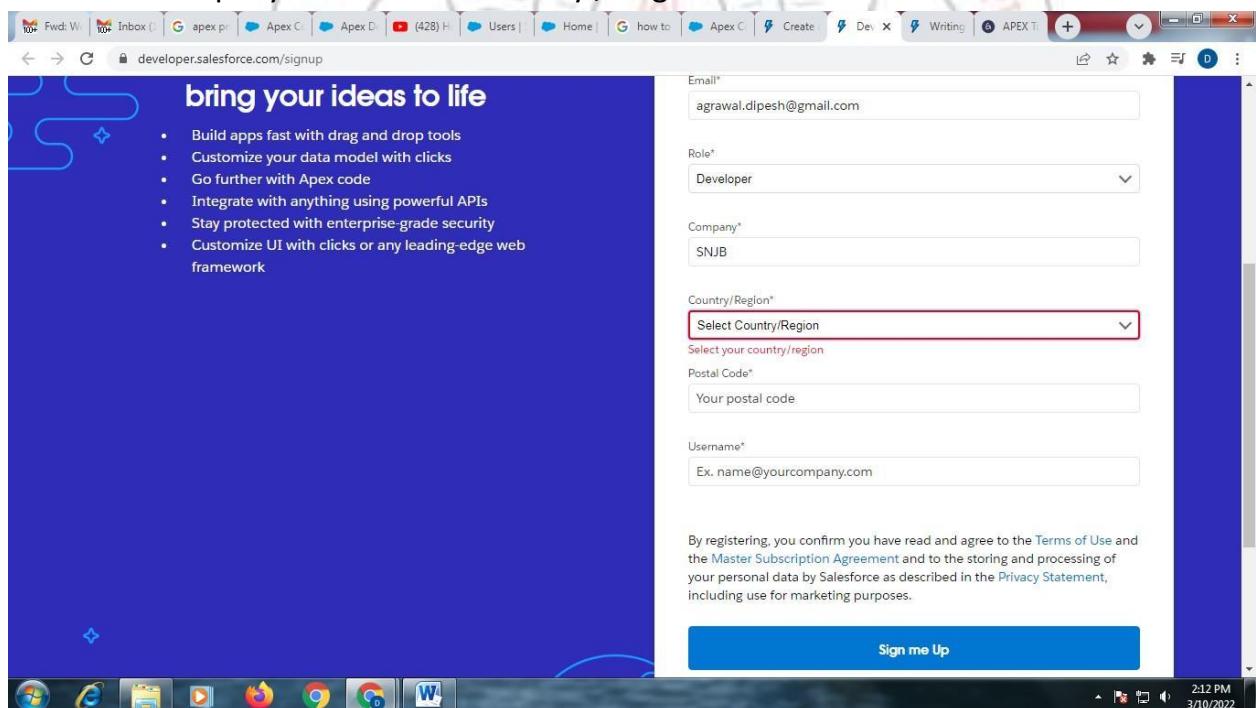
Create Account on Developer Console, using following steps Developer.salesforce.com/signup



Enter your First Name, Last Name and Email Select your Job Role as – Developer



Enter Your Company Name Select Country / Region



Enter Your Postal Code

Enter user name ↗ different than your Email-id

For ex. I have used email id for my salesforce account as ↗

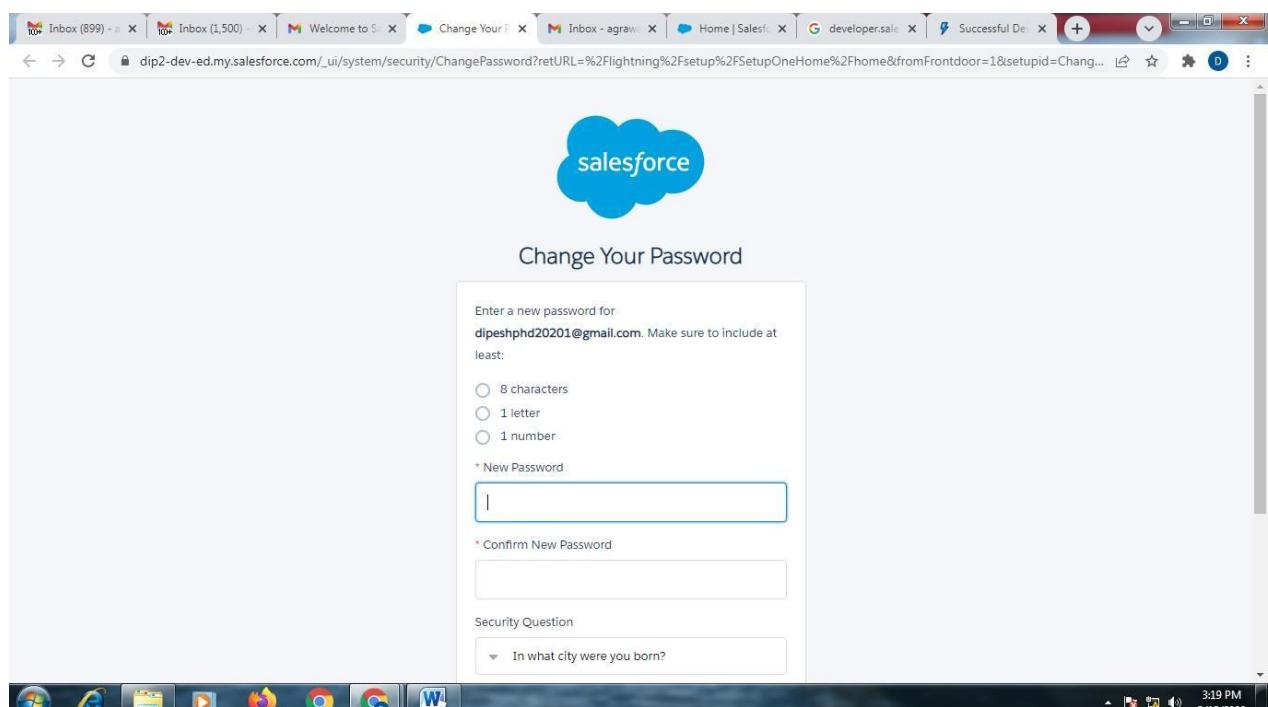
dfgdfg.ghjghj@gmail.com,

Then, for Developer account, I will use different email-id as

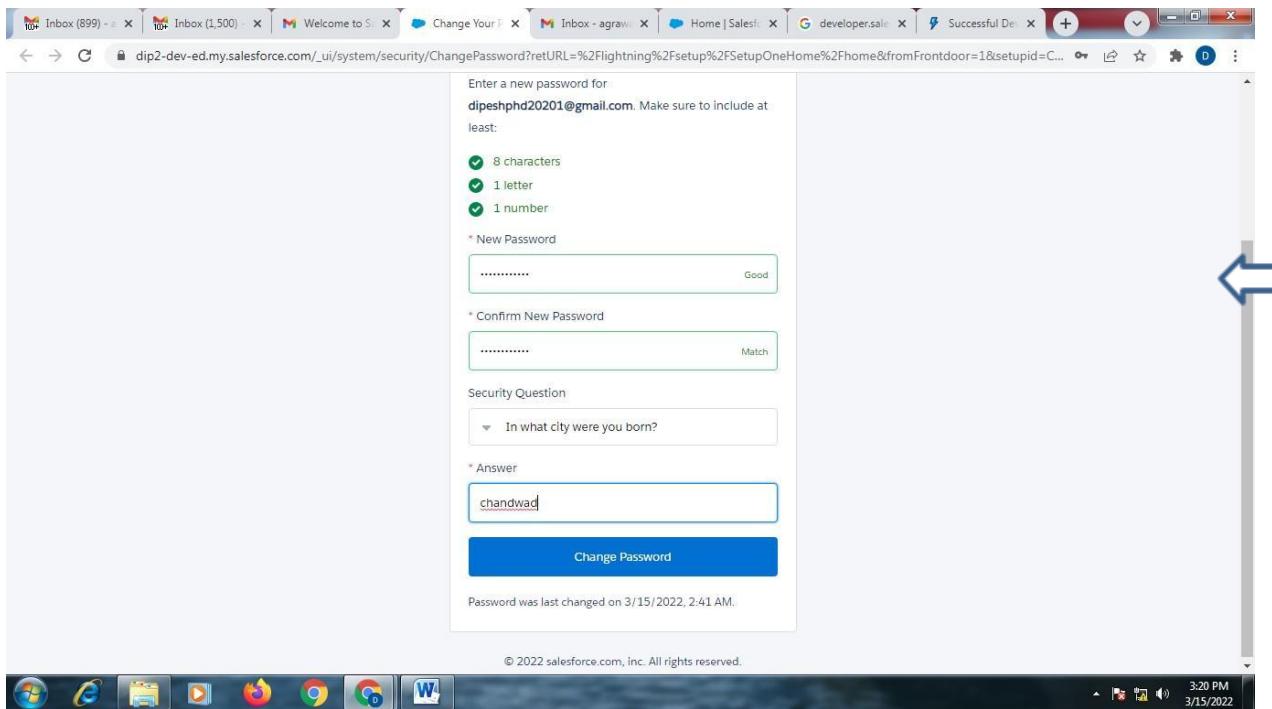
↗ jghjghj.fujifuiuy@gmail.com

You will get an email of verification link in your email account, as below ↗ click on “Verify your account”

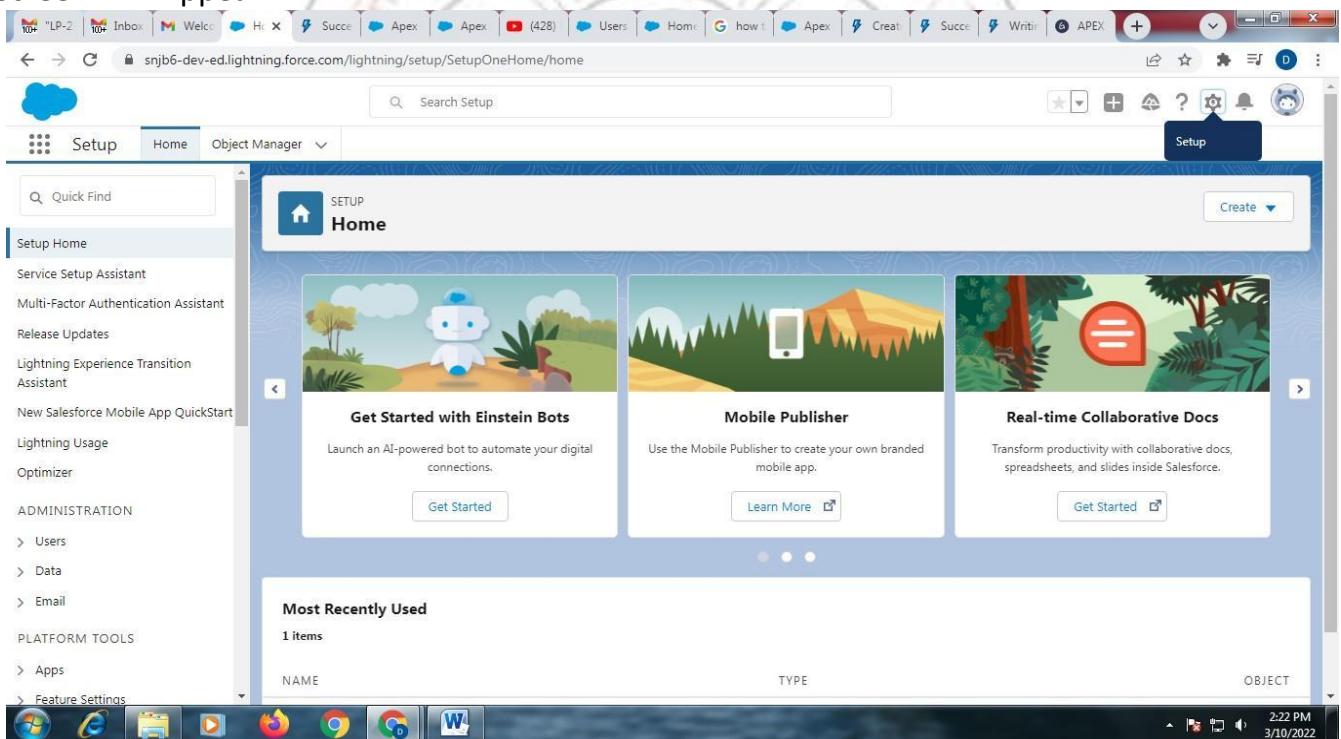
Following Screen Will Appear ↗



ESTD - 1928

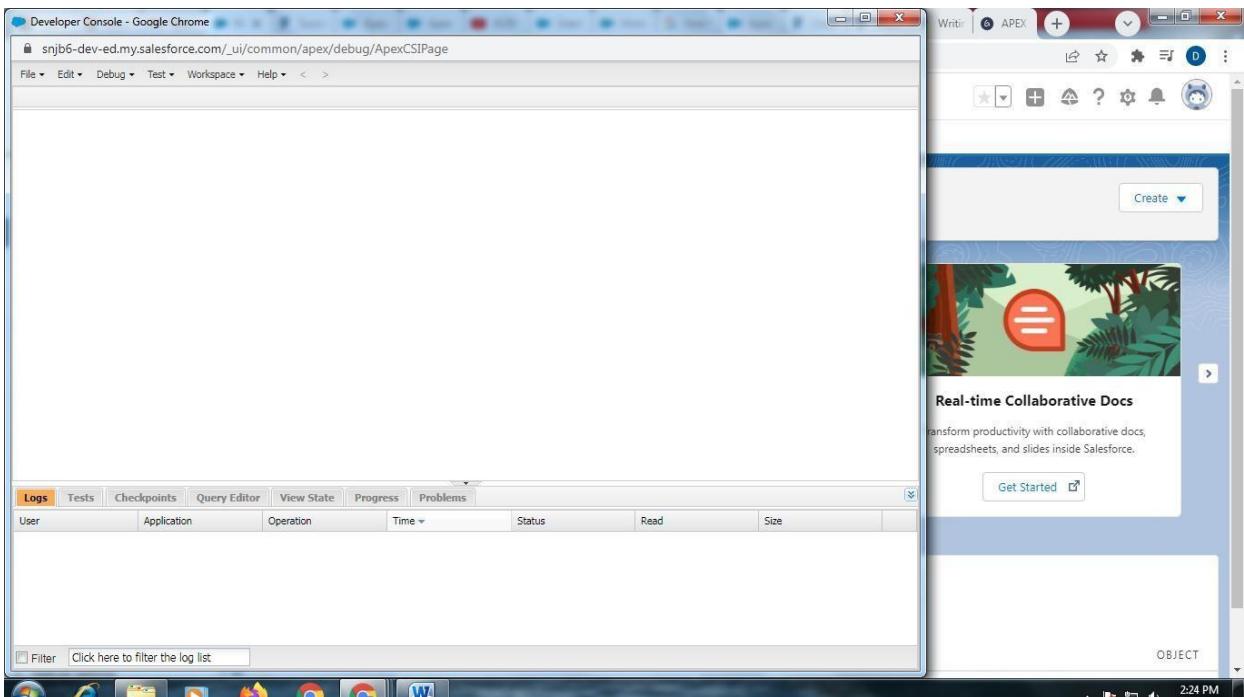


Enter Password, Security Question and Answer of itClick on “Change Password” Following Screen Will Appear ↴



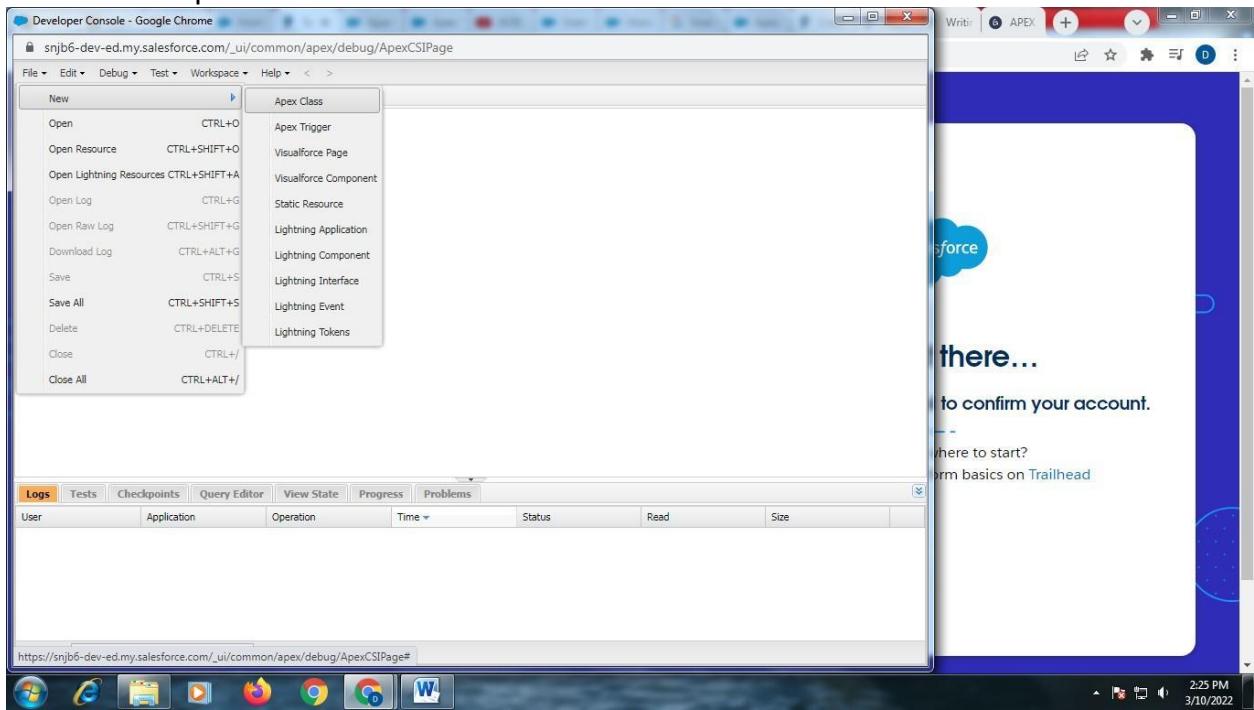
Click on Setup

Select Developer Console

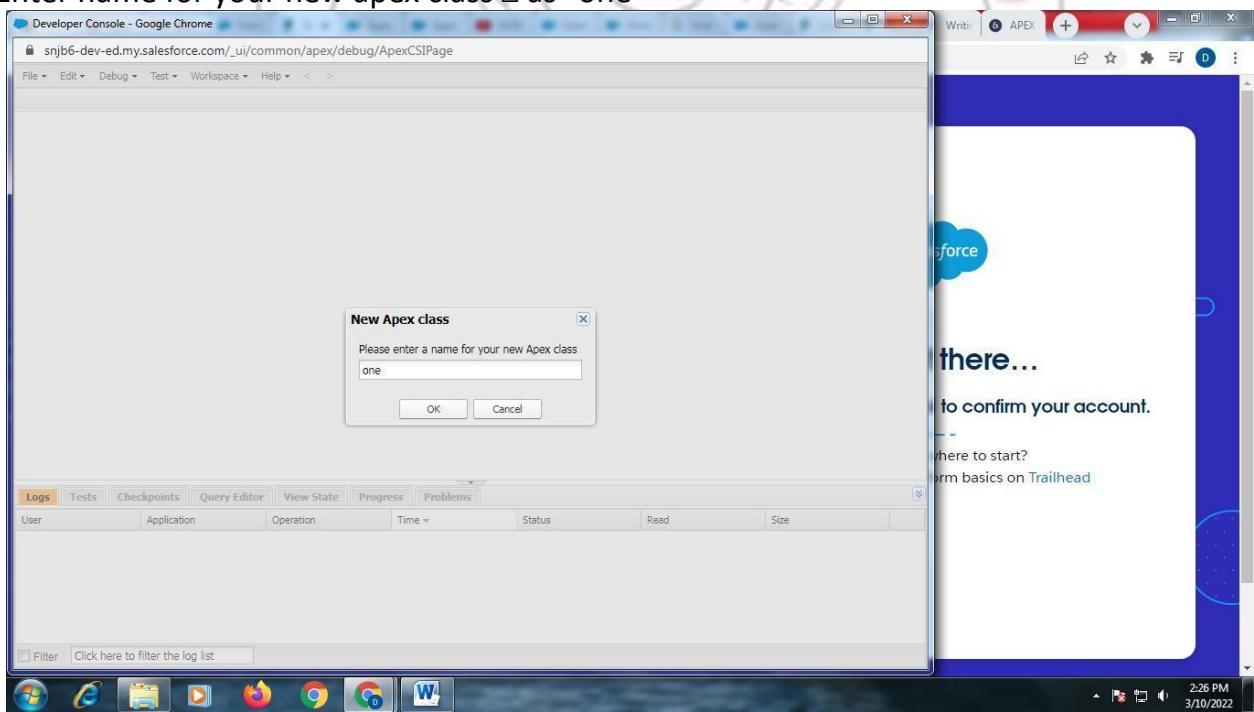
Developer Console will be opened as below 



File ▾ New ▾ Apex Class

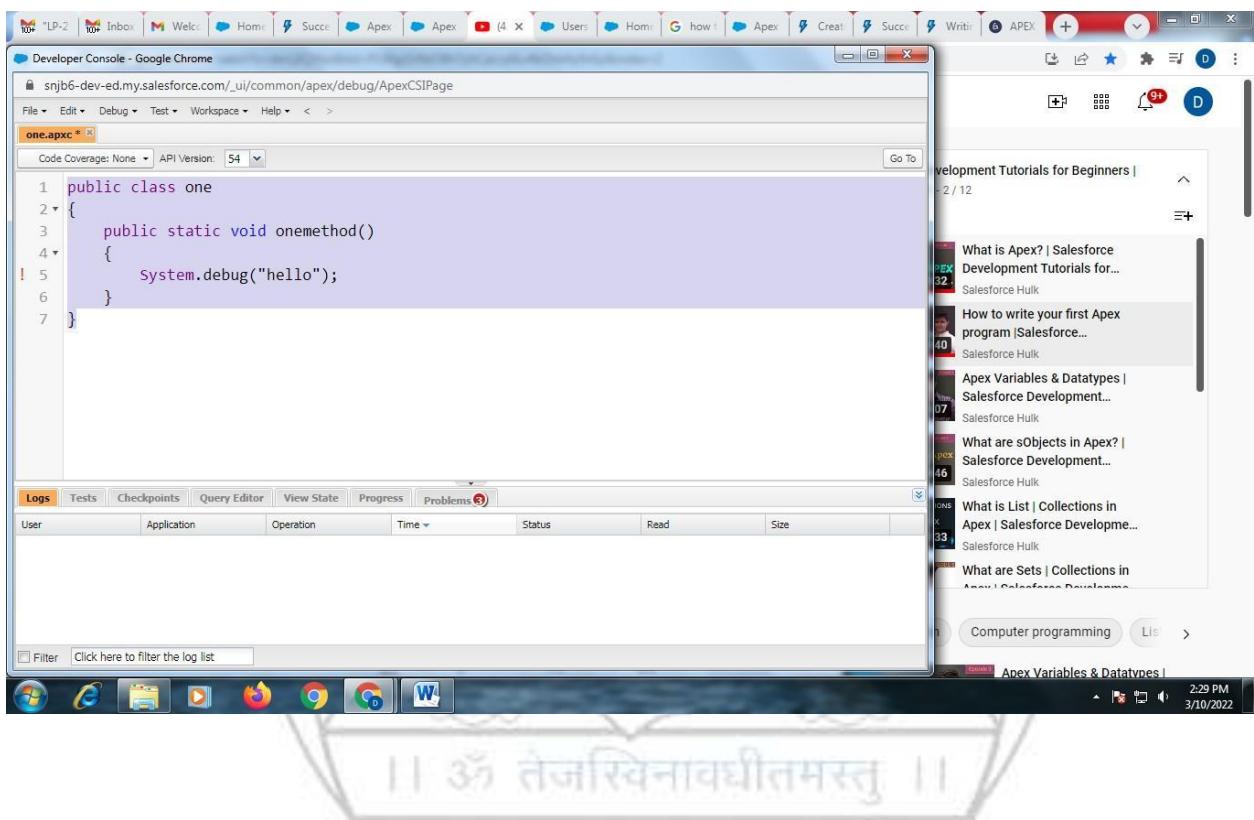


Enter name for your new apex class ▾ as "one"



Write Following Code ↴

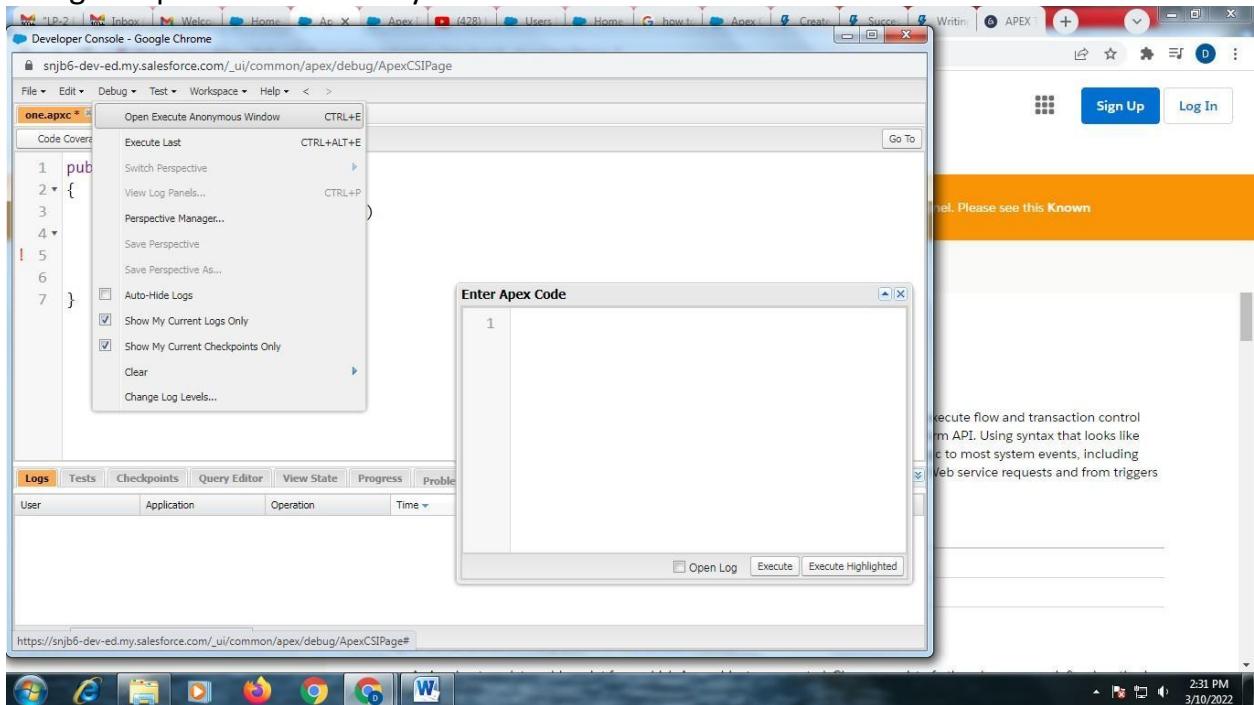
```
public class one
{
    public static void onemethod()
    {
        System.debug("hello");
    }
}
```



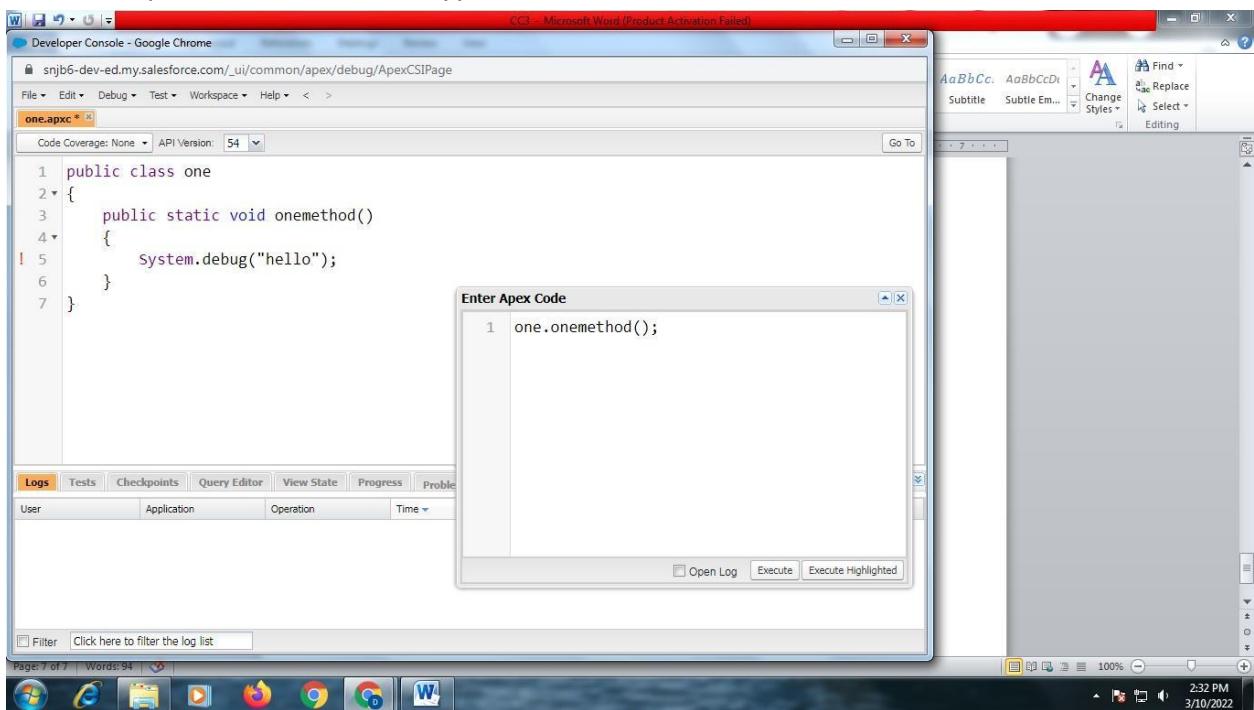
Save the code using File → Save

Debug the code using following steps ↗

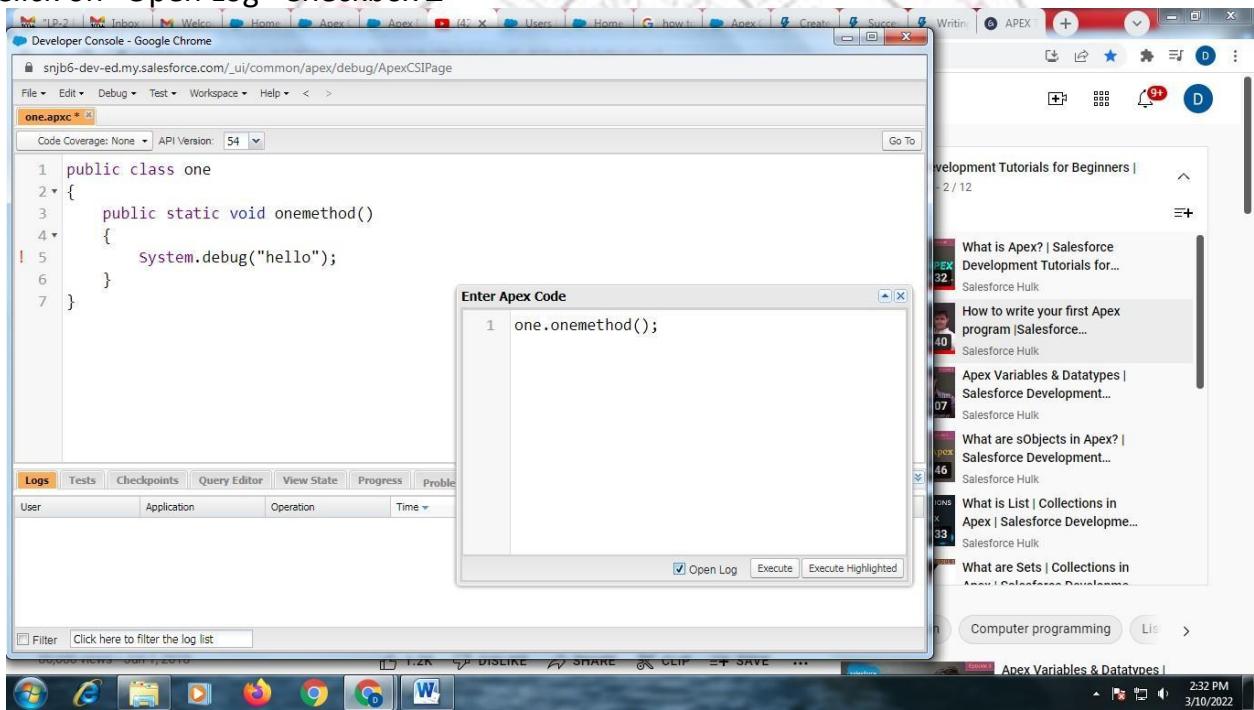
Debug ↗ “Open Execute Anonymous Window”



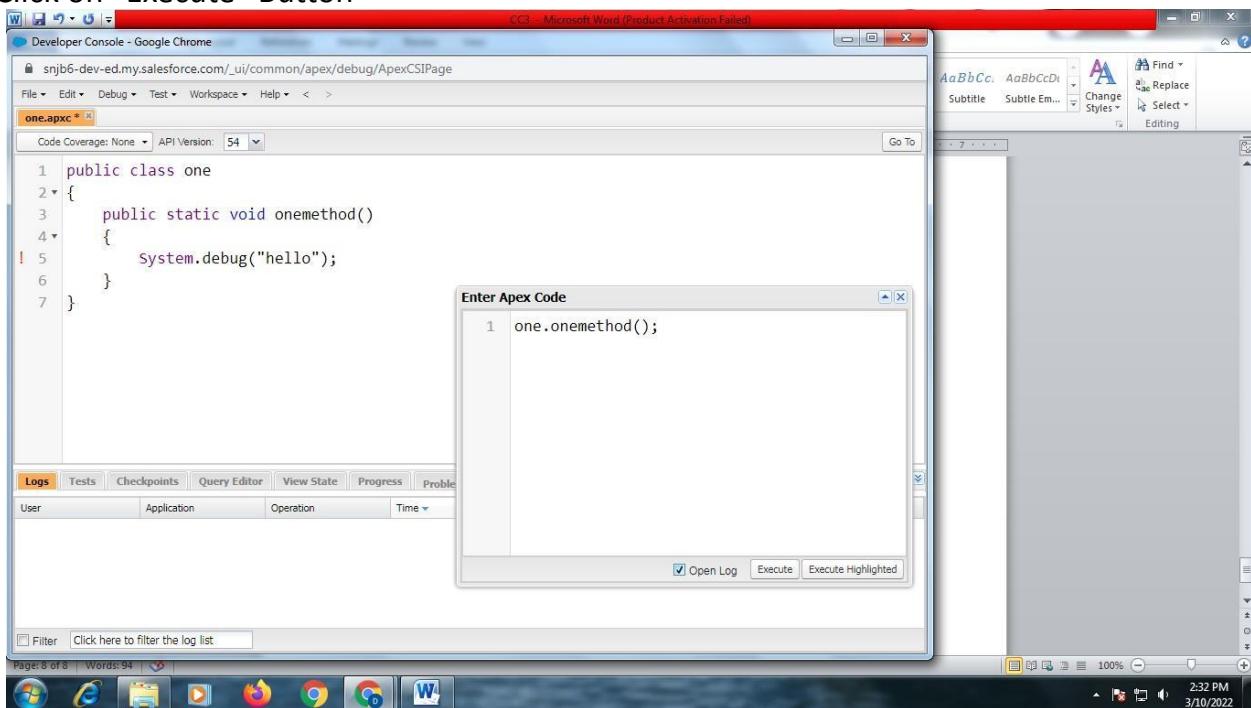
In “Enter Apex Code” window, Type “one.onemethod();”



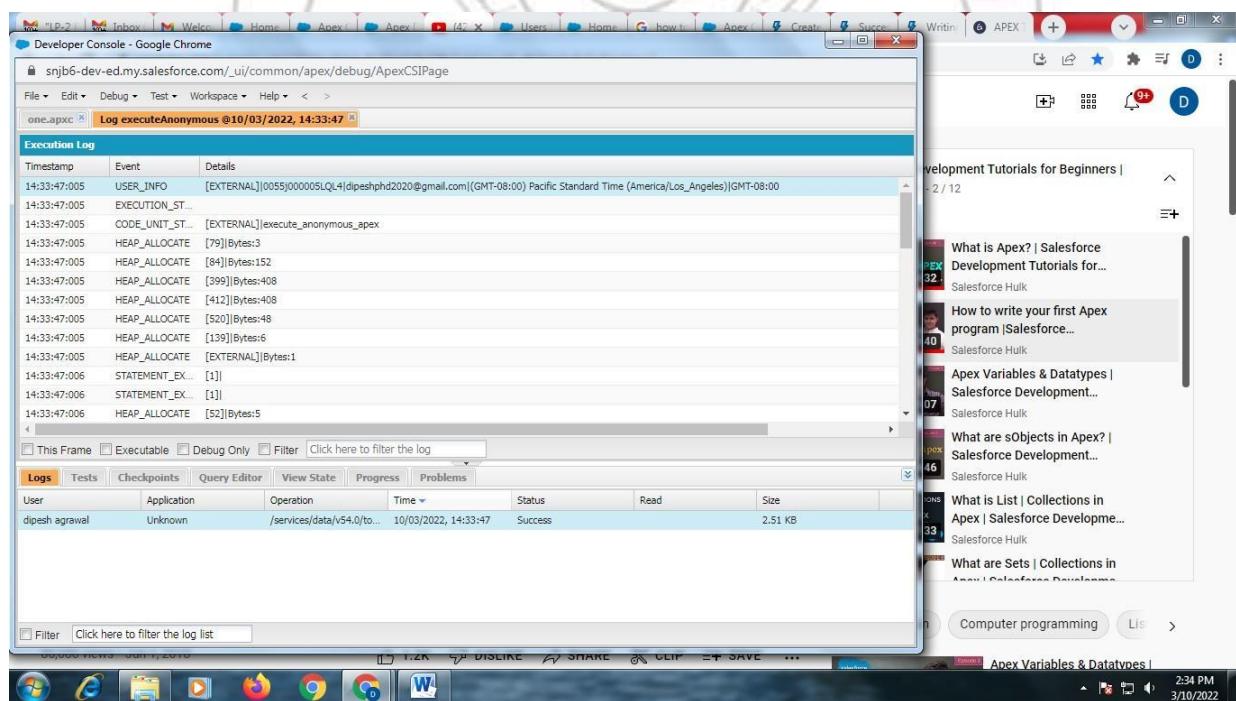
Click on “Open Log” Checkbox



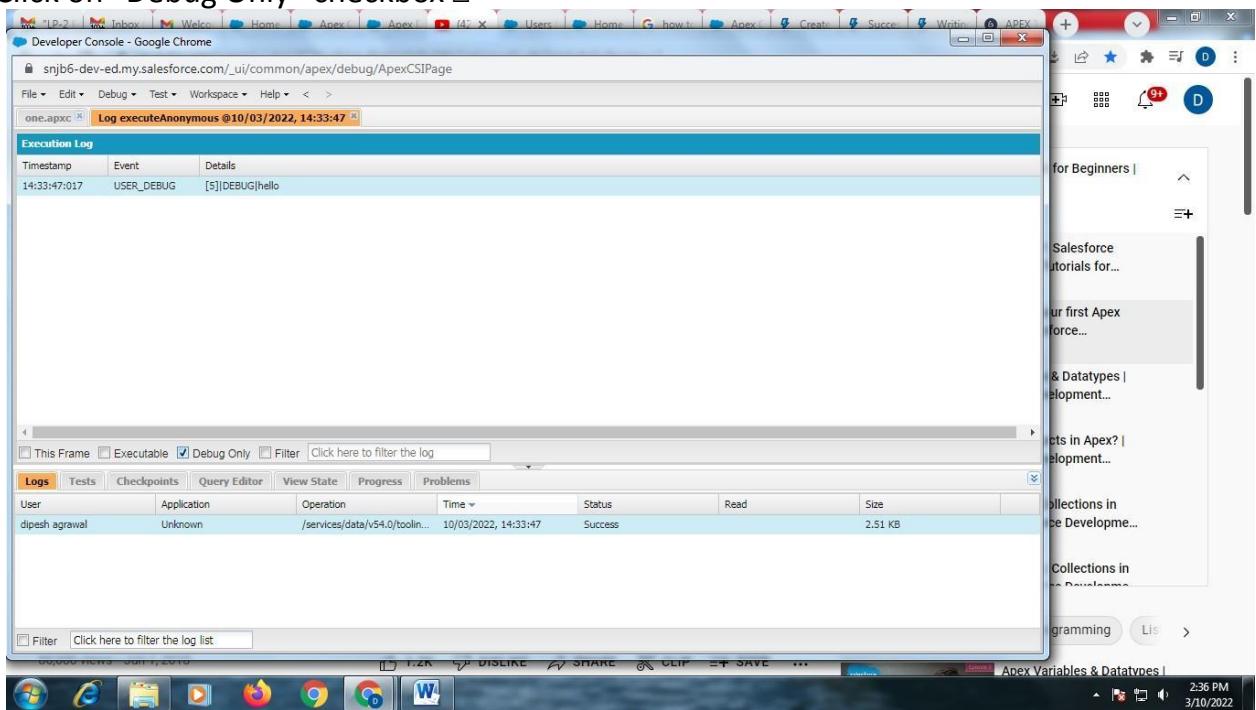
Click on “Execute” Button



Debug Log will be opened in the following window



Click on “Debug Only” checkbox ☰



Observe the output in ☰ “Execution Log”

Assignment Questions ☰

1. What is Salesforce?
2. What does Salesforce do?
3. What is Salesforce used for?
4. What is Apex?
5. When Should Developer Choose Apex?

Conclusion ☰

Created an Application in SalesForce.com using Apex programming Language.

SNJB's Late Sau. K. B. Jain College of Engineering, Chandwad

Department of Computer Engineering

Course Name:Laboratory Practice II(310258):Cloud Computing

Class:Third Year (TE) Div A/ Div B

Batch:T1/T2/T3/T4

Name:

Roll No:

Assignment No: 10

Answers (A) – 5M	Coding Efficiency (C) – 5M	Viva (V) – 5M	Timely Completion (T) – 5M	Total(20M)	Sign

Date of Performance:..... .**Date of Completion:**.....

1. Title of Assignment:

Design and develop custom Application (Mini Project) using Sales force Cloud.

2. Objective:

1. To Learn & develop the application in Salesforce.com
2. Create Application in Salesforce

3. Outcome: Design and develop applications on cloud

4. Software and Hardware Requirement:

Software Requirement: login required for SalesForce.com

Hardware Requirement: Internet Connection, PC with Min. 2GB RAM, Core i5 Processor

5.Relevant Theory :

What is Salesforce?

Salesforce is the world's best cloud-based customer relationship management (CRM) platform. It is an integrated CRM platform that provides a single shared view of each customer for all the departments within an organization, such as Marketing, Sales, Commerce, and Service.

The Cloud Services That Are Offered By Salesforce Are:



Salesforce Sales Cloud – The Sales Cloud is a CRM platform that enables you to manage your organization's sales, marketing, and customer support facets. If your company is engaged in business-to-business (B2B) and business-to-customer (B2C), then a sales cloud is the service your sales team needs.



Salesforce Marketing Cloud – The marketing cloud provides you with one of the world's most powerful digital marketing platforms. The marketers in your organization can use it to manage customer journey, email, mobile, social media, web personalization, content creation, content management, and data analytics.



Salesforce Service Cloud – The Service Cloud is a service platform for your organization's customer service and support team. It provides features like case tracking and social networking plug-in for conversation and analytics. This not only helps your agents to solve customer problems faster but also gives your customers access to answers. Using these answers your customers can solve problems on their own.



Salesforce Community Cloud – If you need a social platform for your organization to connect and facilitate communication among your employees, partners and customers then Salesforce Community Cloud is the service you need. You can use this platform to exchange data and images in real-time.



Salesforce Commerce Cloud – The commerce cloud enables your organization to provide seamless customer service and experience irrespective of your customer's location (online or in-store). It also provides for customer data integration so that your consumers can have a better experience. If your goal is to provide customers with a positive, engaging customer experience, Commerce Cloud is the service you need.



Salesforce Analytics Cloud – The Analytics Cloud provides a business intelligence platform for your organization to work with large data files, create graphs, charts and other pictorial representations of data. It is optimized for mobile access and data visualization and can be integrated with other Salesforce clouds.



Salesforce App Cloud – To develop custom apps that will run on the Salesforce platform, you can use the Salesforce App Cloud. It provides you with a collection of development tools that you can utilize to create custom applications. Some of the tools in the App Cloud include:

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What Is Custom Application Development?

Custom software application development is the process by which a company is able to design personalized software solutions for a specific user or group of users within their organization. The resultant applications will be able to address company needs more effectively and precisely than off-the-shelf options. However, the time, money, and talent needed to design and implement these custom applications have historically been prohibitive. Only the most successful organizations could afford to create their own app solutions.

Steps in Details:

Steps for creating & Starting Saleceforce.com applcaiton

Step-1: Account Creation in Salesforce

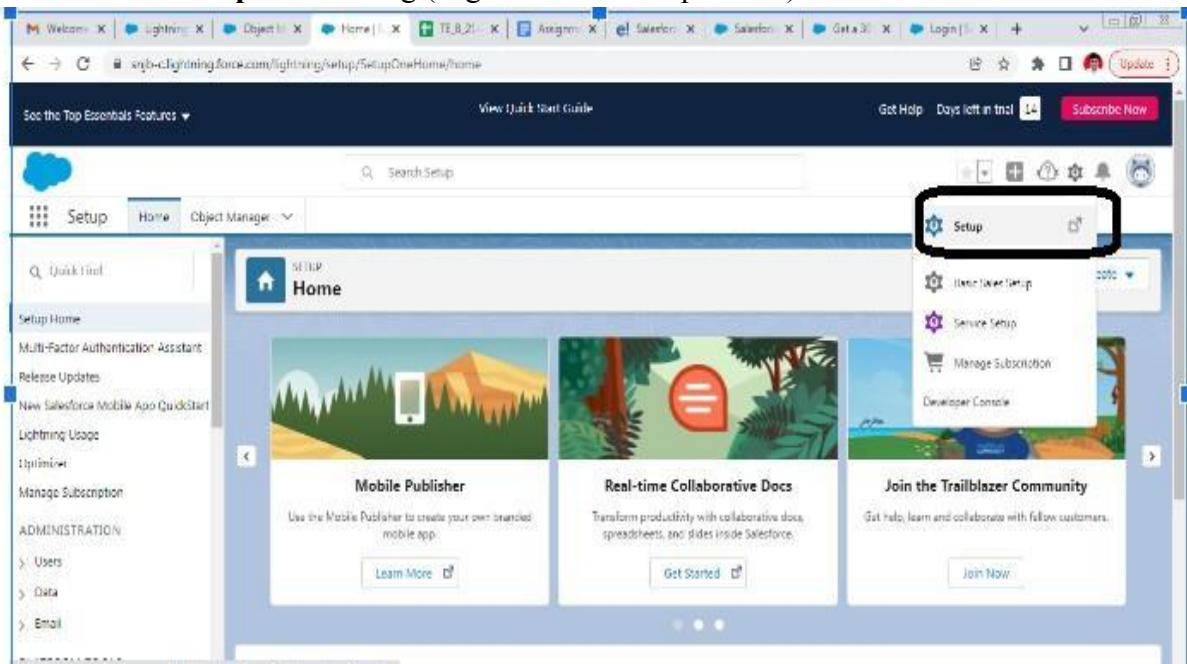


ESTD - 1928

Step-2: Logged into salesforce.com by registered user



Step-3: Click on a Setup from setting (Right side of the top corner)



ESTD - 1928

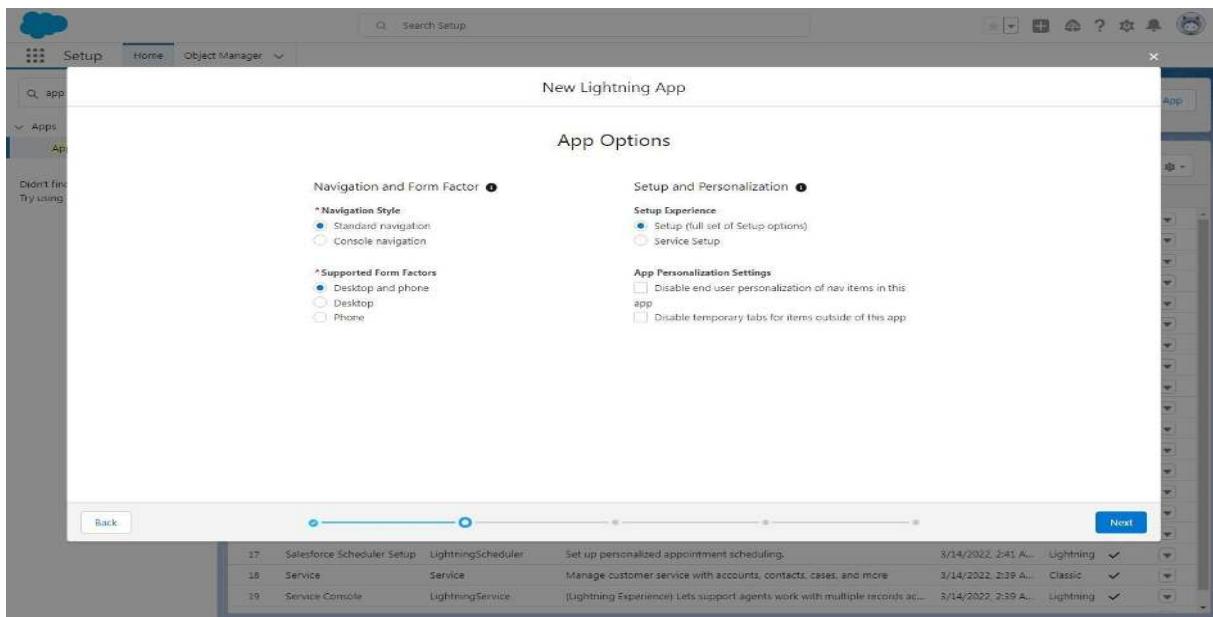
Step-4: Search for App Manager and click on New Lightning App

The screenshot shows the Salesforce Setup interface. At the top left, there is a search bar with the text "app manager". At the top right, there are two buttons: "New Lightning App" and "New Connected App". Below the search bar is a sidebar with a "Setup" icon, "Home", and "Object Manager" options. The main content area displays a table titled "Lightning Experience App Manager" with 20 items. The columns are "App Name", "Developer Name", "Description", "Last Modified...", "Ap...", and "Vi...". The table lists various built-in apps like All Tabs, Analytics Studio, App Launcher, etc.

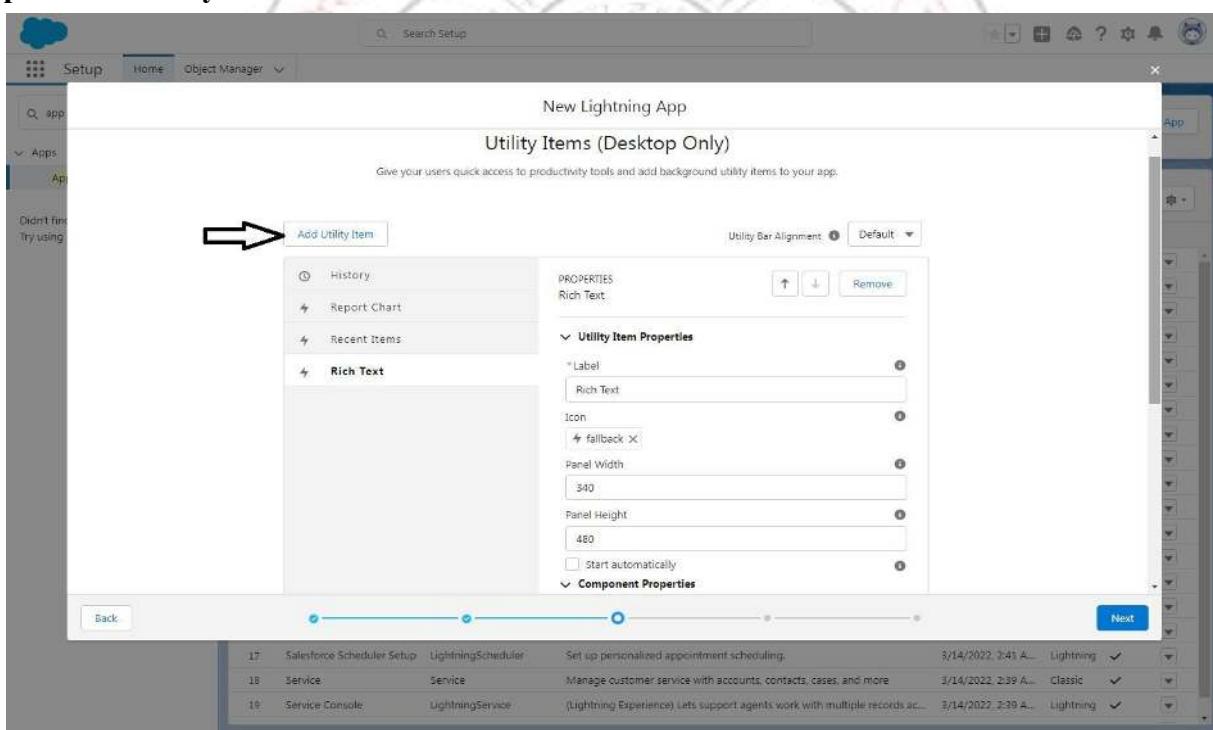
Step-5: Give App Name, fill in other details and click on Next button

The screenshot shows the "New Lightning App" configuration page. The title is "New Lightning App". The main section is "App Details & Branding". Under "App Details", there are fields for "App Name" (StudentLearn), "Developer Name" (Jordy), and "Description" (This is Student Learning App). Under "App Branding", there is a "Primary Color Hex Value" set to "#007002". There is also an "Image" field with a placeholder image of a person at a computer. At the bottom, there is a "Next" button and a preview of the app launcher with the name "StudentLearn".

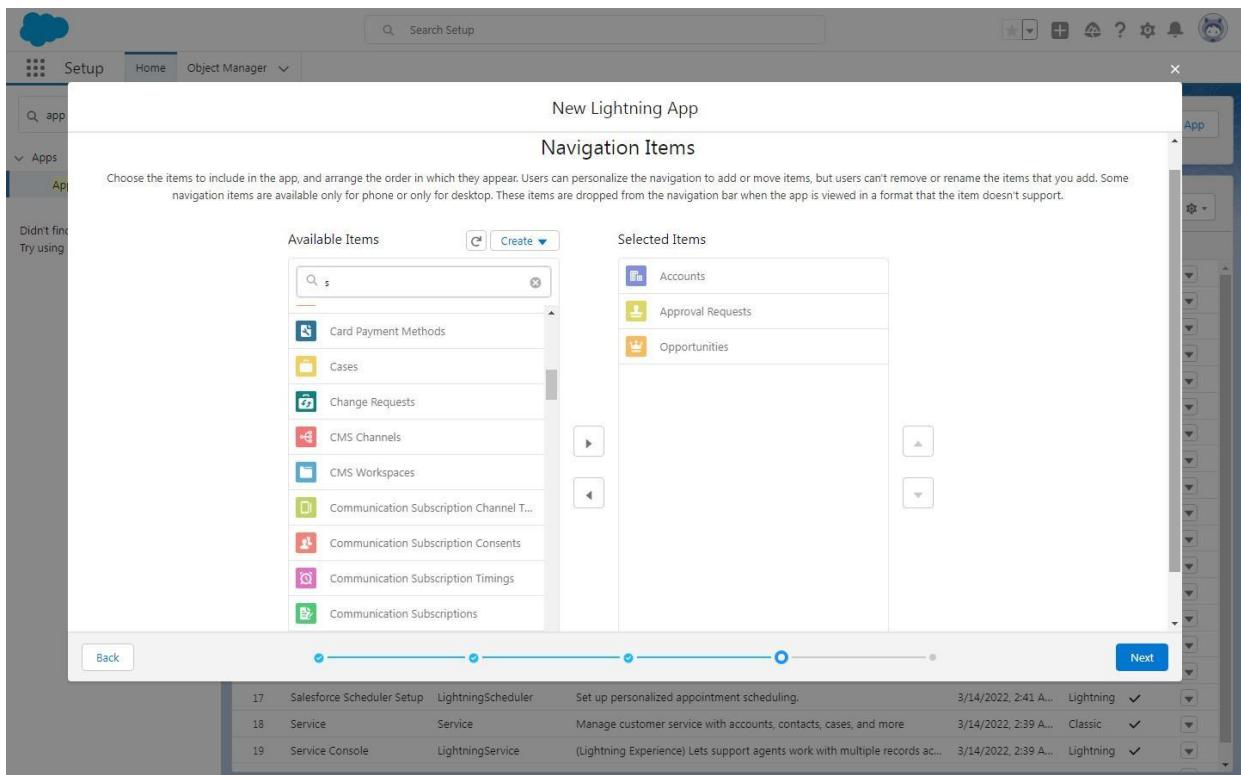
Step-6: Click Next again in-app option



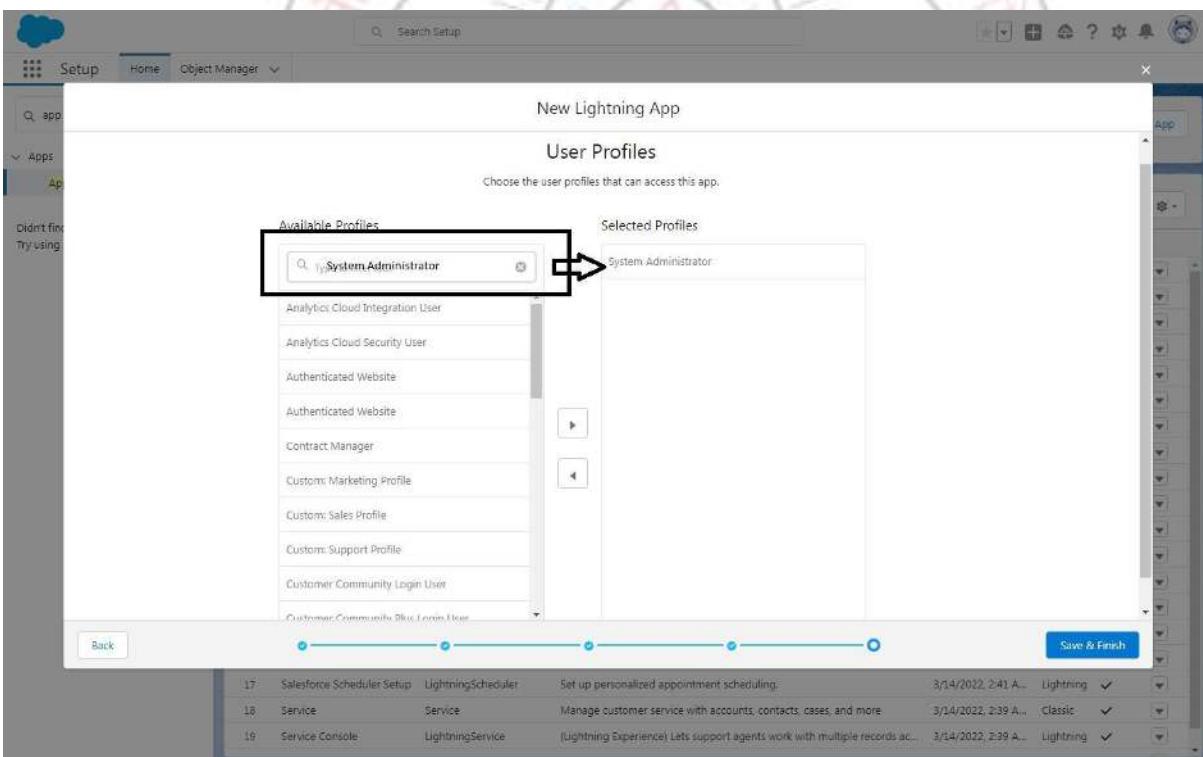
Step-7: Add Utility Items



Step-8: Add Navigation Items



Step-9: Choose the user profiles that can access this app and Click on Save & Finish button



Step-10: Search for the Application Name: StudentLearn

The screenshot shows the Salesforce Lightning Experience App Manager. At the top, there is a search bar with the text "StudentLearn". Below the search bar is a table listing various apps. The first app in the list is "All Tabs" (Developer Name: AllTabSet). The table includes columns for App Name, Developer Name, Description, Last Modified, Type, and Visibility. A large red arrow points to the search bar.

App Name	Developer Name	Description	Last Modified	Type	Visibility
All Tabs	AllTabSet	Build Tableau CRM dashboards and apps	3/14/2022, 2:39 A...	Classic	✓
Analytics Studio	Insights	Build Tableau CRM dashboards and apps	3/14/2022, 2:39 A...	Classic	✓
App Launcher	AppLauncher	App Launcher tabs	3/14/2022, 2:42 A...	Lightning	✓
Bolt Solutions	LightningBolt	Discover and manage business solutions designed for your industry.	3/14/2022, 2:42 A...	Lightning	✓
Community	Community	Salesforce CRM Communities	3/14/2022, 2:39 A...	Classic	✓
Content	Content	Salesforce CRM Content	3/14/2022, 2:39 A...	Classic	✓
Digital Experiences	SalesforceCMS	Manage content and media for all of your sites.	3/14/2022, 2:39 A...	Lightning	✓
LearnerView	LearnerView	This application is for insights wrt learners	3/29/2022, 3:43 A...	Lightning	✓
Lightning Usage App	LightningInstrumentati...	View Adoption and Usage Metrics for Lightning Experience	3/14/2022, 2:39 A...	Lightning	✓
Marketing	Marketing	Best-in-class on-demand marketing automation	3/14/2022, 2:39 A...	Classic	✓
Platform	Platform	The fundamental Lightning Platform	3/14/2022, 2:39 A...	Classic	✓
Queue Management	QueueManagement	Create and manage queues for your business.	3/14/2022, 2:39 A...	Lightning	✓
Sales	Sales	The world's most popular sales force automation (SFA) solution	3/14/2022, 2:39 A...	Classic	✓
Sales	LightningSales	Manage your sales process with accounts, leads, opportunities, and more	3/14/2022, 2:39 A...	Lightning	✓
Sales Console	LightningSalesConsole	(Lightning Experience) Lets sales reps work with multiple records on one ...	3/14/2022, 2:39 A...	Lightning	✓
Salesforce Chatter	Chatter	The Salesforce Chatter social network, including profiles and feeds	3/14/2022, 2:39 A...	Classic	✓
Salesforce Scheduler Setup	LightningScheduler	Set up personalized appointment scheduling.	3/14/2022, 2:41 A...	Lightning	✓
Service	Service	Manage customer service with accounts, contacts, cases, and more	3/14/2022, 2:39 A...	Classic	✓
Service Console	LightningService	(Lightning Experience) Lets support agents work with multiple records ac...	3/14/2022, 2:39 A...	Lightning	✓

Step-11: Finally, we get the Custom Fields / Labels as shown below,

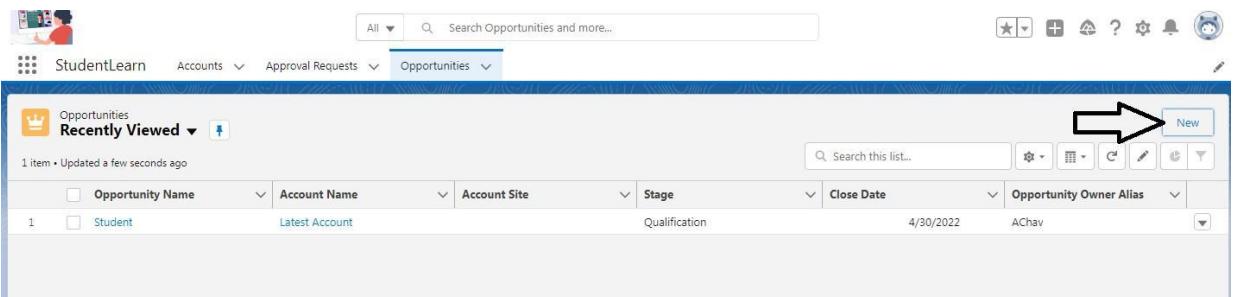
The screenshot shows the Salesforce Accounts page. At the top, there is a search bar with the placeholder "Search Accounts and more...". Below the search bar is a table listing accounts. The first account in the list is "Latest Account" (Account Owner Alias: Achay). A large red arrow points to the table. Below the table, the text "Custom Fields / Labels" is displayed, followed by a downward-pointing arrow. At the bottom of the page, there is a navigation bar with links for History, Report Chart, Recent Items, and Rich Text.

Account Name	Account Site	Phone	Account Owner Alias
Latest Account			Achay

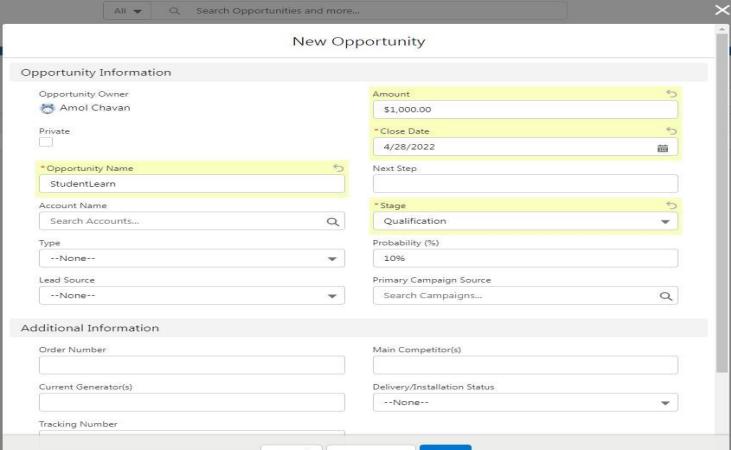
Custom Fields / Labels

History Report Chart Recent Items Rich Text

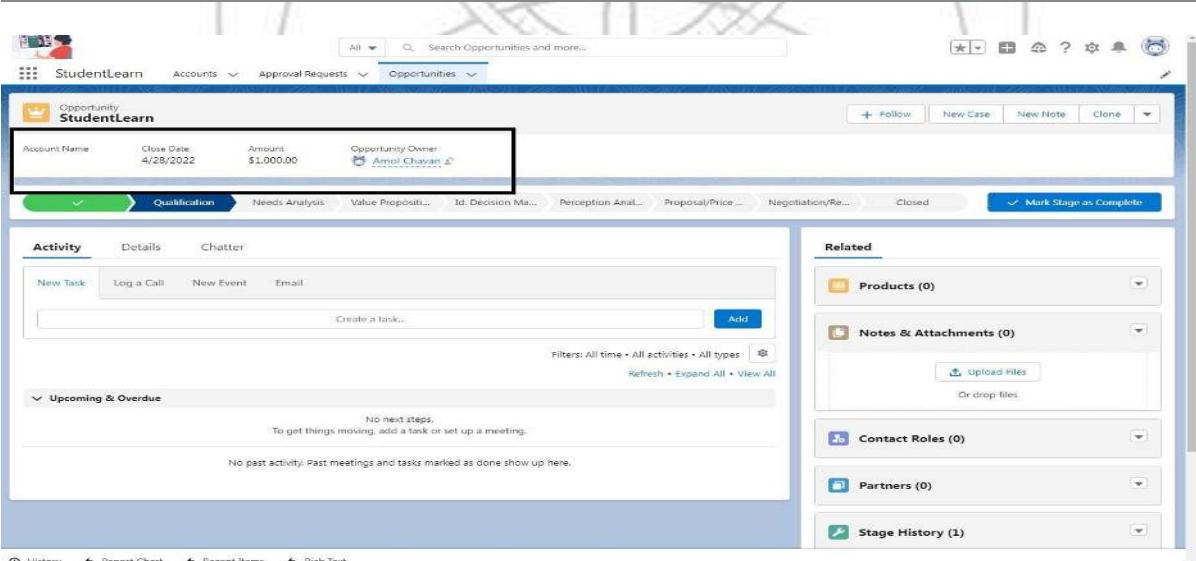
Step- 12: Click on New Button for Adding Records & Finish



The screenshot shows the Salesforce Opportunities list view. A black arrow points to the 'New' button in the top right corner of the interface.



The screenshot shows the 'New Opportunity' modal window. It contains fields for Opportunity Information such as Opportunity Name (StudentLearn), Amount (\$1,000.00), Close Date (4/28/2022), Stage (Qualification), and Probability (%). It also includes sections for Additional Information like Order Number, Current Generator(s), and Tracking Number. Buttons at the bottom include 'Cancel', 'Save & New', and 'Save'.



The screenshot shows the Opportunity detail page for 'StudentLearn'. The top header shows the opportunity name, close date (4/28/2022), amount (\$1,000.00), and owner (Amol Chavan). Below the header, there are tabs for Qualification, Needs Analysis, Value Proposition..., Id. Decision Ma..., Perception Anal..., Proposal/Price..., Negotiation/Re..., and Closed. The 'Activity' tab is selected, showing a list of tasks: New Task, Log a Call, New Event, Email, and a 'Create a task...' input field. The 'Related' section on the right lists Products (0), Notes & Attachments (0), Contact Roles (0), Partners (0), and Stage History (1).

Frequently Asked Questions:

- i) What is Lightning Experience?
- ii) What Object Manager?
- iii) What are Custom Fields?
- iv) What is App Manager?
- v) What is User Profile in Lightning App?

Conclusion:

Hence, successfully created the custom Application SalesForce.com.





Final lab-manual-2023cloud-computing

Computer Engineering (Savitribai Phule Pune University)



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KEYSTONE SCHOOL OF ENGINEERING

Department of Computer Engineering



LABORATORY MANUAL

2022-23

CLOUD COMPUTING LABORATORY
TE-COMPUTER ENGINEERING

SEMESTER-II

Subject Code: 310258

TEACHING SCHEME

Lectures: 4Hrs/Week

Practical: 04 Hours/Week

EXAMINATION SCHEME

Practical : 25Marks

Term Work: 50 Marks

-: Name of Faculty:-
Prof.Radha Tripathi

INDEX

CLOUD COMPUTING LABORATORY

Suggested List of Laboratory Experiments/Assignments

GROUP-A

Sr. No.	TITLE	Page Number
1	<p>Case study on Microsoft azure to learn about Microsoft Azure is a cloud computing platform and infrastructure, created by Microsoft, for building, deploying and managing applications and services through a global network of Microsoft-managed data centers.</p> <p style="text-align: center;">OR</p> <p>Case study on Amazon EC2 and learn about Amazon EC2 web services.</p>	
2	<p>Installation and configure Google App Engine.</p> <p style="text-align: center;">OR</p> <p>Installation and Configuration of virtualization using KVM.</p>	
3	Creating an Application in SalesForce.com using Apex programming Language.	
4	Design and develop custom Application (Mini Project) using Salesforce Cloud.	
5	<p>Mini-Project</p> <p>Setup your own cloud for Software as a Service (SaaS) over the existing LAN in your laboratory. In this assignment you have to write your own code for cloud controller using open-source technologies to implement with HDFS. Implement the basic operations may be like to divide the file in segments/blocks and upload/ download file on/from cloud in encrypted form.</p>	

310258: Laboratory Practice II

Teaching Scheme	Credit	Examination Scheme
PR: 04 Hours/Week	02	TW : 50 Marks PR : 25 Marks

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration- concept, objectives, outcomes, set of typical applications/practicals/ guidelines, and references.

Guidelines for Student Journal

The laboratory practical are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each practical (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, conclusion/analysis. Program codes with sample output of all perform practical's are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Assessment

Continuous assessment of laboratory work is done based on overall performance and lab practicals performance of student. Each lab practical assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab practical assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked

at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended :- 64-bit Windows OS and Linux

Programming tools recommended: - Information Security : - C/C++/Java

Augmented and Virtual Reality :- Unity, C#, Blender, VRTK, ARTK, Vuforia VR Devices: HTC Vive, Google Daydream and Samsung gear VR.

Cloud Computing :- NA

Software Modeling and Architectures: Front end:HTML5, Bootstrap, jQuery, JS etc. Backend: MySQL/MongoDB/NodeJS

Practical No.	Laboratory Assignments
Cloud Computing	
1	Case study on Amazon EC2 and learn about Amazon EC2 web services.
2	Installation and configure Google App Engine.
3	Creating an Application in SalesForce.com using Apex programming Language.
4	Design and develop custom Application (Mini Project) using Salesforce Cloud.
5	<p style="text-align: center;">Mini-Project</p> <p>Setup your own cloud for Software as a Service (SaaS) over the existing LAN in your laboratory. In this assignment you have to write your own code for cloud controller using open-source technologies to implement with HDFS. Implement the basic operations may be like to divide the file in segments/blocks and upload/ download file on/from cloud in encrypted form.</p>

Practical No: 01

Practical Title: Case study on Amazon EC2 and learn about Amazon EC2 web services.

Objectives:

- To learn Amazon EC2 web services
- To study on Amazon EC2 and learn about Amazon EC2 web services.

Hardware Requirements :

- Pentium IV with latest configuration

Software Requirements :

- Ubuntu 20.04

Theory:

An EC2 instance is nothing but a virtual server in Amazon [Web services](#) terminology. It stands for Elastic Compute Cloud. It is a web service where an AWS subscriber can request and provision a compute server in AWS cloud.

An on-demand EC2 instance is an offering from AWS where the subscriber/user can rent the virtual server per hour and use it to deploy his/her own applications.

The instance will be charged per hour with different rates based on the type of the instance chosen. AWS provides multiple instance types for the respective business needs of the user.

Thus, you can rent an instance based on your own CPU and memory requirements and use it as long as you want. You can terminate the instance when it's no more used and save on costs. This is the most striking advantage of an on-demand instance- you can drastically save on your CAPEX.

Let us see in detail how to launch an on-demand EC2 instance in AWS Cloud. Login and access to AWS services

Step 1) In this step,

- Login to your AWS account and go to the AWS Services tab at the top left corner.
- Here, you will see all of the AWS Services categorized as per their area viz. Compute, Storage, Database, etc. For creating an EC2 instance, we have to choose Compute & EC2 as in the next step.

The screenshot shows the AWS Services menu with the 'Compute' section highlighted by a red box. The 'Compute' section includes options like Storage & Content Delivery, Database, Networking, Developer Tools, Management Tools, and Security & Identity.

- Open all the services and click on EC2 under Compute services. This will launch the dashboard of EC2.

Here is the EC2 dashboard. Here you will get all the information in gist about the AWS EC2 resources running.

The screenshot shows the EC2 Dashboard. The left sidebar has 'EC2 Dashboard' selected. The main area displays resource statistics: 3 Running Instances, 0 Dedicated Hosts, 12 Volumes, 22 Key Pairs, 0 Placement Groups, 4 Elastic IPs, 17 Snapshots, 0 Load Balancers, and 28 Security Groups. A red box highlights these statistics.

Resource Type	Count
Running Instances	3
Dedicated Hosts	0
Volumes	12
Key Pairs	22
Placement Groups	0
Elastic IPs	4
Snapshots	17
Load Balancers	0
Security Groups	28

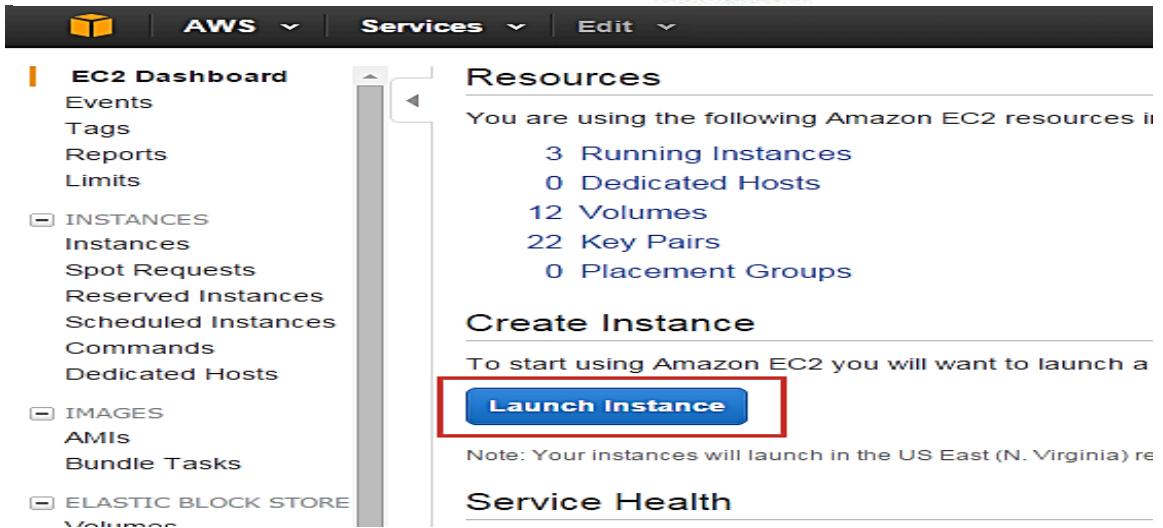
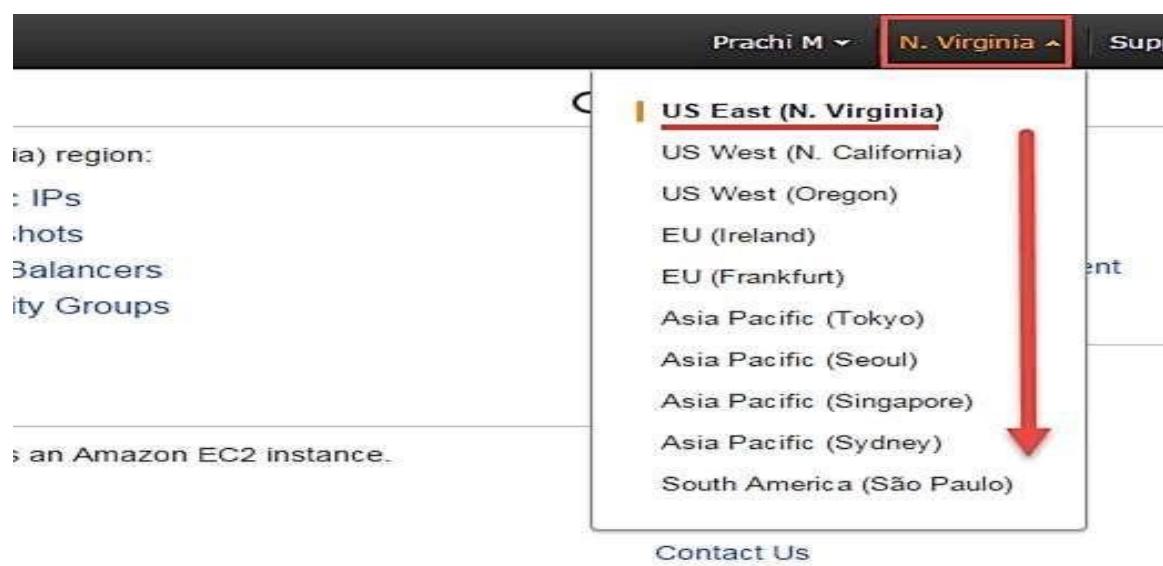
Step 2) On the top right corner of the EC2 dashboard, choose the AWS Region in which you want to provision the EC2 server.

Here we are selecting N. Virginia. AWS provides 10 Regions all over the globe

Step 3) In this step

Engineering
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- Once your desired Region is selected, come back to the EC2 Dashboard.
- Click on 'Launch Instance' button in the section of Create Instance (as shown below).



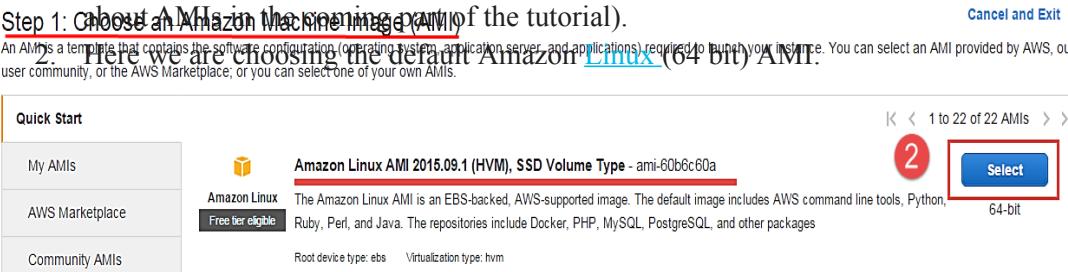
- Instance creation wizard page will open as soon as you click 'Launch Instance'. Choose AMI

Step 1) In this step we will do,

- You will be asked to choose an AMI of your choice. (An AMI is an Amazon Machine Image. It is a template basically of an Operating System platform which you can use as a base to start your instance). Once you launch an EC2 instance from your preferred

Step 1: Choose an AMI in the coming part of the tutorial.

AMIs are templates that contain the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.



Engineering

Choose EC2 Instance Types

Step 1) In the next step, you have to choose the type of instance you require based on your business needs.

- 1. We will choose t2.micro instance type, which is a 1vCPU and 1GB memory

The screenshot shows the 'Choose an Instance Type' step of the AWS EC2 wizard. A red box highlights the 't2.micro' instance type in the list. Step 1 is indicated by a red circle on the 't2.micro' entry. Step 2 is indicated by a red circle on the 'Next: Configure Instance Details' button. The table lists various instance types with their details like Family, Type, vCPUs, Memory (GB), Instance Storage (GB), EBS-Optimized Available, and Network Performance.

Family	Type	vCPUs	Memory (GB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
General purpose	t2.nano	1	0.5	EBS-only	-	Low to Moderate
General purpose	t2.micro (Selected)	1	1	EBS-only	-	Low to Moderate
General purpose	t2.small	1	2	EBS-only	-	Low to Moderate
General purpose	t2.medium	2	4	EBS-only	-	Low to Moderate
General purpose	t2.large	2	8	EBS-only	-	Low to Moderate
General purpose	t2.xlarge	2	8	EBS-only	Yes	Moderate

- In the next step of the wizard, enter details like no. of instances you want to launch at a time.
- Here we are launching one instance.

Step 1) No. of instances - you can provision up to 20 instances at a time. Here we are

The screenshot shows the 'Configure Instance Details' step of the AWS EC2 wizard. A red arrow points to the 'Number of instances' input field, which is set to '1'. The 'Launch into Auto Scaling Group' checkbox is also visible. The purchasing options section is partially visible below.

Step 2) Under Purchasing Options, keep the option of 'Request Spot Instances' unchecked as of now. (This is done when we wish to launch Spot instances instead of on-demand ones. We will come back to Spot instances in the later part of the tutorial.)

The screenshot shows the 'Configure Instance Details' step of the AWS EC2 wizard. A red arrow points to the 'Request Spot instances' checkbox in the 'Purchasing option' section, which is unchecked. The 'Number of instances' field is set to '1'.

Step 3) Next, we have to configure some basic networking details for our EC2 server.

- You have to decide here, in which VPC (Virtual Private Cloud) you want to launch your instance and under which subnets inside your VPC. It is better to determine and plan this prior to launching the instance. Your AWS architecture set-up should include

Engineering • Subnetting should also be pre-planned. E.g.: If it's a web server you should place it in the public subnet and if it's a DB server, you should place it in a private subnet all inside your VPC.

Below,

1. Network section will give a list of VPCs available in our platform.

2. Select an already existing VPC



Here I have selected an already existing VPC where I want to launch my instance.

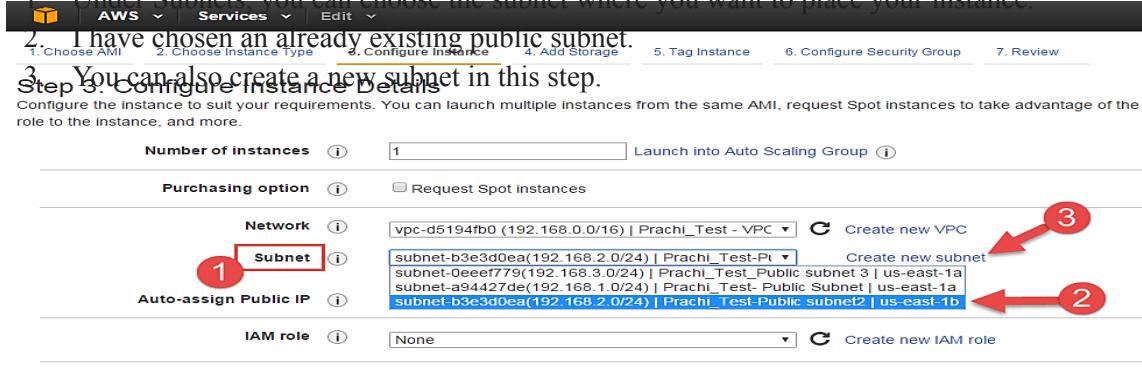
Step 3: Configure Instance Details

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the role to the instance, and more.

Step 4) In this step,

- A VPC consists of subnets, which are IP ranges that are separated for restricting access.
- Below,

1. Under Subnets, you can choose the subnet where you want to place your instance.



- Once your instance is launched in a public subnet, AWS will assign a dynamic public IP to it from their pool of IPs.

Step 5) In this step,

- You can choose if you want AWS to assign it an IP automatically, or you want to do it manually later. You can enable/ disable 'Auto assign Public IP' feature here likewise.

- Here we are going to assign this instance a static IP called as EIP (Elastic IP) later. So we keep this feature disabled as of now.

The screenshots show three different configurations for the 'Auto-assign Public IP' field:

- Screenshot 1:** The dropdown menu is open, showing 'Use subnet setting (Disable)' and 'Use subnet setting (Enable)'. A red arrow points to the 'Use subnet setting (Enable)' option.
- Screenshot 2:** The dropdown menu is open, showing 'Shared - Run a shared hardware instance' and 'Dedicated - Run a Dedicated instance'. A red arrow points to the 'Shared - Run a shared hardware instance' option.
- Screenshot 3:** The 'Tenancy' dropdown menu is open, showing 'Shared - Run a shared hardware instance' and 'Dedicated - Run a Dedicated instance'. A red arrow points to the 'Shared - Run a shared hardware instance' option.

The 'Tenancy' field is highlighted with a red box in all three screenshots.

Step 3: Configure Instance Details

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the lower pricing, assign an access management role to the instance, and more.

Number of instances: 1 Launch into Auto Scaling Group

Purchasing option: Request Spot instances

Network: vpc-d5194fb0 (192.168.0.0/16) | Prachi_Test - VPC | Create new VPC

Subnet: subnet-b3e3d0ea(192.168.2.0/24) | Prachi_Test-Subnet | Create new subnet
251 IP Addresses available

Auto-assign Public IP: Use subnet setting (Disable) | Use subnet setting (Enable) | Create new IAM role

IAM role: Enable | Disable

Shutdown behavior: Stop

Tenancy: Shared - Run a shared hardware instance | Shared - Run a shared hardware instance | Dedicated - Run a Dedicated instance | Dedicated host - Launch this instance on a Dedicated host

Network interfaces: vpc-d5194fb0 (192.168.0.0/16) | Prachi_Test - VPC | Create new VPC

Subnet: subnet-b3e3d0ea(192.168.2.0/24) | Prachi_Test-Subnet | Create new subnet
251 IP Addresses available

Auto-assign Public IP: Use subnet setting (Disable)

IAM role: None | Create new IAM role

Shutdown behavior: Stop

Enable termination protection: Protect against accidental termination

Monitoring: Enable CloudWatch detailed monitoring
Additional charges apply

Tenancy: Shared - Run a shared hardware instance | Shared - Run a shared hardware instance | Dedicated - Run a Dedicated instance | Dedicated host - Launch this instance on a Dedicated host

Next: Add storage

Engineering Launch Status

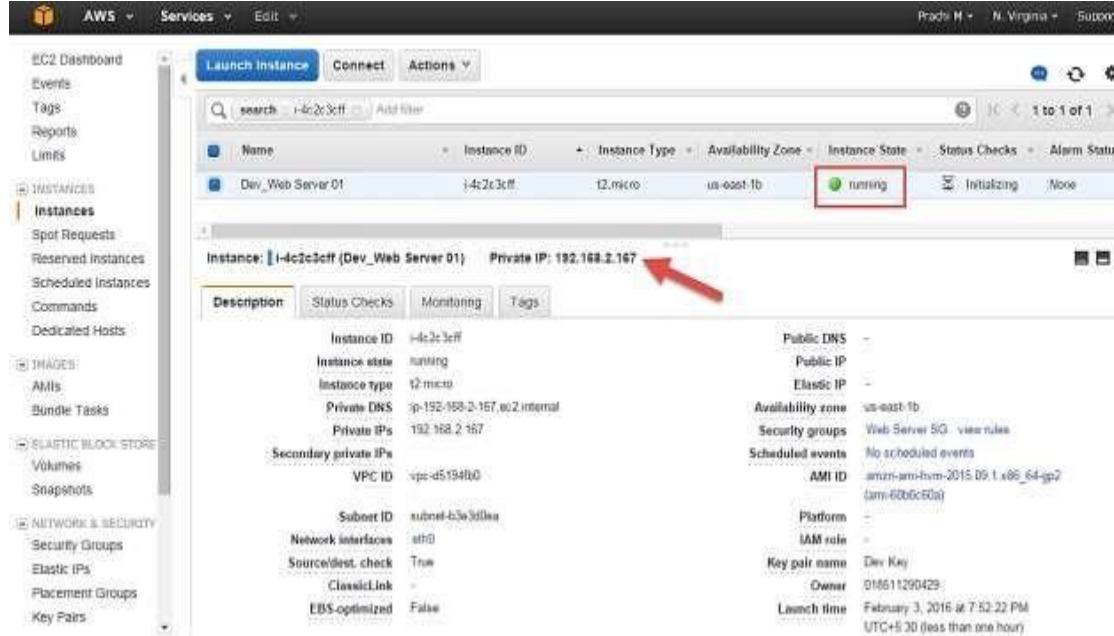
Your instances are now launching

The following instance launches have been initiated: i-4c2c3cff [Hide launch log](#)

Creating security groups	Successful (sg-62d7d21b)
Authorizing inbound rules	Successful
Initiating launches	Successful
Applying tags	Successful
Launch initiation complete	

Get notified of estimated charges

Create billing alerts to get an email notification when estimated charges on your AWS bill exceed an amount.



Conclusion:

Thus, we saw in detail how to create an on-demand EC2 instance in this tutorial. Because it is an on-demand server, you can keep it running when in use and 'Stop' it when it's unused to save on your costs.

Engineering

Practical No : 2

Practical Title: Installation and configure Google App Engine.

Objectives:

- To learn basic of Google App Engine.
- To install and configure Google App Engine.

Hardware Requirements :

- Pentium IV with latest configuration

Software Requirements :

- Ubuntu 20.04, Web application i.e. Google App Engine

Theory:

Introduction

Google App Engine is a web application hosting service. By “web application,” we mean an application or service accessed over the Web, usually with a web browser: storefronts with shopping carts, social networking sites, multiplayer games, mobile applications, survey applications, project management, collaboration, publishing, and all the other things we’re discovering are good uses for the Web. App Engine can serve traditional website content too, such as documents and images, but the environment is especially designed for real-time dynamic applications. Of course, a web browser is merely one kind of client: web application infrastructure is well suited to mobile applications, as well.

In particular, Google App Engine is designed to host applications with many simultaneous users. When an application can serve many simultaneous users without degrading performance, we say it scales. Applications written for App Engine scale automatically. As more people use the application, App Engine allocates more resources for the application and manages the use of those resources. The application itself does not need to know anything about the resources it is using.

The app engine is a Cloud-based platform, is quite comprehensive and combines infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS). The app engine supports the delivery, testing and development of software on demand in a Cloud computing environment that supports millions of users and is highly scalable.

The company extends its platform and infrastructure to the Cloud through its app engine. It presents the platform to those who want to develop SaaS solutions at competitive costs .Have you ever wondered as to who stands to benefit the most from the Google app engine? If you are a business SME or enterprise which owns any web-based application that needs to be scaled

Engineering

without any compromise on the performance then Google App Engine is a good fit.

Companies like Best Buy and Khan Academy have chosen Google App Engine for their apps.

Google App Engine:

It is a platform-as-a-service (PaaS) Cloud computing platform that is fully managed and uses inbuilt services to run your apps. You can start development almost instantly after downloading the software development kit (SDK). You can go on to the developer's guide right away when you click on the language you wish to develop your app in.

As soon as you have signed up for a Cloud account, you can build your app:

- With the template/HTML package in Go
- With Jinja2 and webapp2 in Python
- With

PHP Generally Available

- With Maven in Java

Features

These are covered by the depreciation policy and the service-level agreement of the app engine. Any changes made to such a feature are backward-compatible and implementation of such a feature is usually stable. These include data storage, retrieval, and search; communications; process management; computation; app configuration and management.

- Data storage, retrieval, and search include features such as HRD migration tool, Google Cloud SQL, logs, datastore, dedicated Memcache, blobstore, Memcache and search.
- Communications include features such as XMPP, channel, URL fetch, mail, and Google Cloud Endpoints.
- Process management includes features like scheduled tasks and task queue
- Computation includes images.
- Compute App management and configuration cover app identity, users, capabilities, traffic splitting, modules, SSL for custom domains, modules, remote access, and multitenancy.

Advantages of Google App

- Engine: Infrastructure for Security**

Around the world, the Internet infrastructure that Google has is probably the most secure. There is rarely any type of unauthorized access till date as the application data and code are stored in highly secure servers. You can be sure that your app will be available to users worldwide at all times since Google has several hundred servers globally. Google's security and privacy policies are applicable to the apps developed using Google's infrastructure.

Scalability

For any app's success, this is among the deciding factors. Google creates its own apps using GFS, Big Table and other such technologies, which are available to you when you

Engineering

utilize the Google app engine to create apps. You only have to write the code for the app and Google looks after the testing on account of the automatic scaling feature that the app engine has. Regardless of the amount of data or number of users that your app stores, the app engine can meet your needs by scaling up or down as required.

□ Performance and Reliability

Google is among the leaders worldwide among global brands. So, when you discuss performance and reliability you have to keep that in mind. In the past 15 years, the company has created new benchmarks based on its services' and products' performance. The app engine provides the same reliability and performance as any other Google product.

□ Cost Savings

You don't have to hire engineers to manage your servers or to do that yourself. You can invest the money saved into other parts of your business.

□ Platform Independence

You can move all your data to another environment without any difficulty as there is not many dependencies on the app engine platform.

Conclusion :

Thus, We have installed and Configured Google App Engine.

Engineering
g

Practical No: 3

Practical Title: Creating an Application in SalesForce.com using Apex programming Language

Objectives:

- To learn salesforce cloud administration
- To create application in SalesForce.com using Apex programming

Hardware Requirements :

- Pentium IV with latest configuration

Software Requirements :

- Ubuntu 20.04, Web application i.e. salesforce.com

Theory:**What is Apex?**

Apex is a proprietary language developed by the Salesforce.com. As per the official definition, Apex is a strongly typed, object-oriented programming language that allows developers to execute the flow and transaction control statements on the Force.com platform server in conjunction with calls to the Force.com API.

It has a Java-like syntax and acts like database stored procedures. It enables the developers to add business logic to most system events, including button clicks, related record updates, and Visual force pages. Apex code can be initiated by Web service requests and from triggers on objects. Apex is included in Performance Edition, Unlimited Edition, Enterprise Edition, and Developer edition.

Features of Apex as a Language

Let us now discuss the features of Apex as a Language – Integrated

Apex has built in support for DML operations like INSERT, UPDATE, DELETE and also DML Exception handling. It has support for inline SOQL and SOSL query handling which returns the set of sObject records. We will study the sObject, SOQL, SOSL in detail in future chapters.

Java like syntax and easy to use

Apex is easy to use as it uses the syntax like Java. For example, variable declaration, loop syntax and conditional statements.

Strongly Integrated With Data

Apex is data focused and designed to execute multiple queries and DML statements together. It issues multiple transaction statements on Database.

Strongly Typed

Apex is a strongly typed language. It uses direct reference to schema objects like Object and any invalid reference quickly fails if it is deleted or if is of wrong data type.

Multitenant Environment

Apex runs in a multitenant environment. Consequently, the Apex runtime engine is designed to guard closely against runaway code, preventing it from monopolizing shared resources. Any code that violates limits fails with easy-to-understand error messages.

Upgrades Automatically

Apex is upgraded as part of Salesforce releases. We don't have to upgrade it manually.

Easy Testing

Apex provides built-in support for unit test creation and execution, including test results that indicate how much code is covered, and which parts of your code can be more efficient.

When Should Developer Choose Apex?

Apex should be used when we are not able to implement the complex business functionality using the pre-built and existing out of the box functionalities. Below are the cases where we need to use apex over Salesforce configuration.

Apex Applications

We can use Apex when we want to

- Create email services for email blast or
- Create Web services with integrating other systems.

email setup.

- Perform complex validation over multiple objects at the same time and also custom validation implementation

- Create complex business processes that are not supported by existing workflow functionality

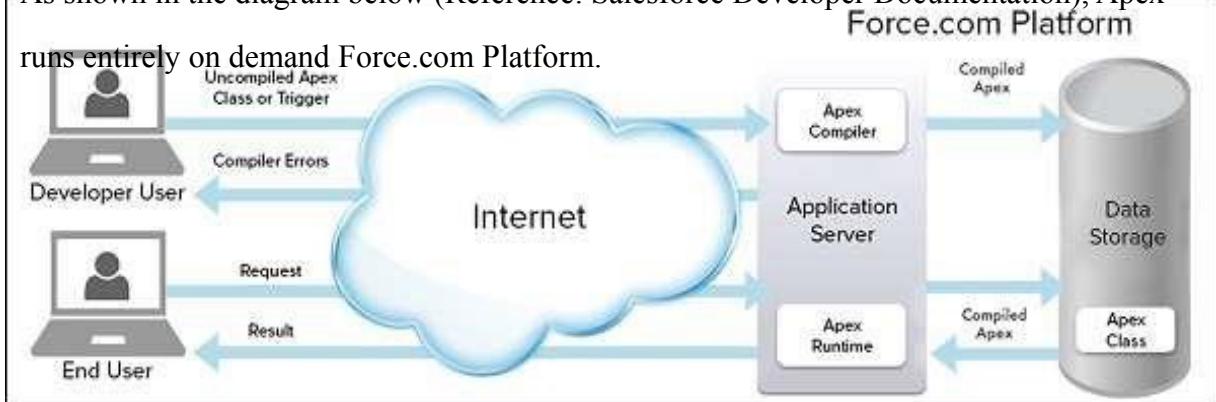
or flows.

- Create custom transactional logic (logic that occurs over the entire transaction, not just with a single record or object) like using the Database methods for updating the records.

- Perform some logic when a record is modified or modify the related object's record when there is some event which has caused the trigger to fire.

Working Structure of Apex

As shown in the diagram below (Reference: Salesforce Developer Documentation), Apex



Flow of Actions

There are two sequence of actions when the developer saves the code and when an end user performs some action which invokes the Apex code as shown below –

Developer Action

When a developer writes and saves Apex code to the platform, the platform application server first compiles the code into a set of instructions that can be understood by the Apex runtime interpreter, and then saves those instructions as metadata.

End User Action

When an end-user triggers the execution of Apex, by clicking a button or accessing a Visual force page, the platform application server retrieves the compiled instructions from the metadata and sends them through the runtime interpreter before returning the result. The end user observes no differences in execution time as compared to the standard application platform request.

Since Apex is the proprietary language of Salesforce.com, it does not support some features which a general programming language does. Following are a few features which Apex does not support –

- It cannot show the elements in User Interface. to
- You cannot change the standard SFDC provided functionality and also it is not possible prevent the standard functionality execution. to
- You cannot change the standard SFDC provided functionality and also it is not possible prevent the standard functionality execution.
- Creating multiple threads is also not possible as we can do it in other languages.

Understanding the Apex Syntax

Apex code typically contains many things that we might be familiar with from other programming languages.

Variable Declaration

As strongly typed language, you must declare every variable with data type in Apex. As seen in the code below (screenshot below), lstAcc is declared with data type as List of Accounts.

SOQL Query

This will be used to fetch the data from Salesforce database. The query shown in screenshot below is fetching data from Account object.

Loop Statement

This loop statement is used for iterating over a list or iterating over a piece of code for a specified number of times. In the code shown in the screenshot below, iteration will be same as the number of records we have.

Flow Control Statement

The If statement is used for flow control in this code. Based on certain condition, it is decided whether to go for execution or to stop the execution of the particular piece of code. For example, in the code shown below, it is checking whether the list is empty or it contains records.

DML Statement

Performs the records insert, update, upsert, delete operation on the records in database. For example, the code given below helps in updating Accounts with new field value.

Apex Code Development Tools

In all the editions, we can use any of the following three tools to develop the code –

- Force.com Developer Console
- Force.com IDE
- Code Editor in the Salesforce User Interface

Conclusion:

Thus, We have created an Application in SalesForce.com using Apex programming Language.

Reference: https://www.tutorialspoint.com/apex/apex_overview.html

Practical No : 04

Practical Title: Design and develop custom Application (Mini Project) using Salesforce Cloud.

Objectives:

- To learn salesforce cloud administration
- To install and configure the salesforce cloud administrative features

Hardware Requirements :

- Pentium IV with latest configuration

Software Requirements :

- Ubuntu 20.04, Web application i.e. salesforce.com

Theory:

Introduction

Salesforce.com Inc. is an American cloud-based software company headquartered in San Francisco, California. Though the bulk of its revenue comes from a customer relationship management (CRM) product, Salesforce also sells a complementary suite of enterprise applications focused on customer service, marketing automation, analytics and application development.

Salesforce is the primary enterprise offering within the Salesforce platform. It provides companies with an interface for case management and task management, and a system for automatically routing and escalating important events. The Salesforce customer portal provides customers the ability to track their own cases, includes a social networking plug-in that enables the user to join the conversation about their company on social networking websites, provides analytical tools and other services including email alert, Google search, and access to customers' entitlement and contracts.

Lightning Platform

Lightning Platform (also known as Force.com) is a platform as a service (PaaS) that allows developers to create add-on applications that integrate into the main Salesforce.com application. These third-party applications are hosted on Salesforce.com's infrastructure. Force.com applications are built using declarative tools, backed by Lightning and Apex (a proprietary Java-like programming language for Force.com) and Lightning and Visual force (a framework that includes an XML syntax typically used to generate HTML). The Force.com platform typically receives three complete releases a year. As the platform is provided as a service to its developers, every single development instance also receives all these updates.

Community Cloud

Community Cloud provides Salesforce customers the ability to create online web properties for external collaboration, customer service, channel sales, and other custom portals I their instance of Salesforce. Tightly integrated to Sales Cloud, Service Cloud, and App Cloud, Community Cloud can be quickly customized to provide a wide variety of web properties Salesforce Sales Cloud Salesforce Sales Cloud is a customer relationship management (CRM) platform designed to support sales, marketing and customer support in both business-to-business (B2B) and business-to-customer (B2C) contexts. Sales Cloud is a fully customizable product that brings all the customer information together in an integrated platform that incorporates marketing, lead generation, sales, customer service and business analytics and provides access to thousands of applications through the AppExchange. The platform is provided as Software as a Service (SaaS) for browser-based access; a mobile app is also available. A realtime social feed for collaboration allows users to share information or ask questions of the user community.Salesforce.com offers five versions of Sales Cloud on a per-user, per month basis, from lowest to highest: Group, Professional, Enterprise, Unlimited and Performance. The company offers three levels of support contracts: Standard Success Plan, Premier Success Plan and Premier+ Success Plan.

Create Custom Apps for Salesforce Classic

Create custom apps to give your Salesforce Classic users' access to everything they need all in one place.

If you're new to custom apps, we recommend using Lightning Platform quick start to create an app. With this tool, you can generate a basic working app in just one step.

If you've already created the objects, tabs, and fields you need for your app, follow these steps. With this option, you create an app label and logo, add items to the app, and assign the app to profiles.

1. From Setup, enter Apps in the Quick Find box, then select Apps.
2. Click New.
3. If the Salesforce console is available, select whether you want to define a custom app or a Salesforce console.
4. Give the app a name and description.
An app name can have a maximum of 40 characters, including spaces.
5. Optionally, brand your app by giving it a custom logo.
6. Select which items to include in the app.

7. Optionally, set the default landing tab for your new app using the Default Landing Tab drop-down menu below the list of selected tabs. This determines the first tab a user sees when logging into this app.

Engineering

8. Choose which profiles the app will be visible to.
9. Check the Default box to set the app as that profile's default app, meaning that new users with the profile see this app the first time they log in. Profiles with limits are excluded from this list.
10. Click Save

What is the difference between custom application and console application in salesforce?

A custom application is a collection of tabs, objects etc that function together to solve a particular problem.

A console application uses a specific Salesforce UI - the console. Console applications are intended to enhance productivity by allowing everything to be done from a single, tabbed, screen.

Conclusion:

Thus, We have designed and developed custom application using salesforce cloud.

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Practical No : 05

Practical Title: Setup your own cloud for Software as a Service (SaaS) over the existing LAN in your laboratory. In this assignment you have to write your own code for cloud controller using open-source technologies to implement with HDFS. Implement the basic operations may be like to divide the file in segments/blocks and upload/ download file on/from cloud in encrypted form.

Objectives:

- To set your own cloud for SaaS over existing LAN
- To implement the basic operations may be like to divide the file in segments/blocks

Hardware Requirements :

- Pentium IV with latest configuration

Software Requirements :

- Ubuntu 20.04, VMwareESXi cloud

Theory:

Here we are installing VMwareESXi cloud

- Host/NodeESXi installation:-
- **ESXiHardwareRequirements:-**
- ESXi6.7 requires a host machine with at least two CPU cores.
- ESXi6.7 supports 64-bit x86 processors
- ESXi6.7 requires the NX/XD bit to be enabled for the CPU in the BIOS.
- ESXi6.7 requires a minimum of 4GB of physical RAM. It is recommended to provide atleast 8 GB of RAM to run virtual machines in typical production environments.
- To support 64-bit virtual machines, support for hardware virtualization (IntelVT-x or AMDRVI) must be enabled on x64 CPUs.
- One or more Gigabit or faster Ethernet controllers. For a list of supported network adapter models.
- SCSI disk or a local, non-network, RAID LUN with unpartitioned space for the virtual machines.

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ForSerialATA(SATA), a disk connected through supported SAS controller or supported on board SATA controllers. SATA disks are considered remote not local. These disks are not used as a scratch partition by default because they are seen as remote.



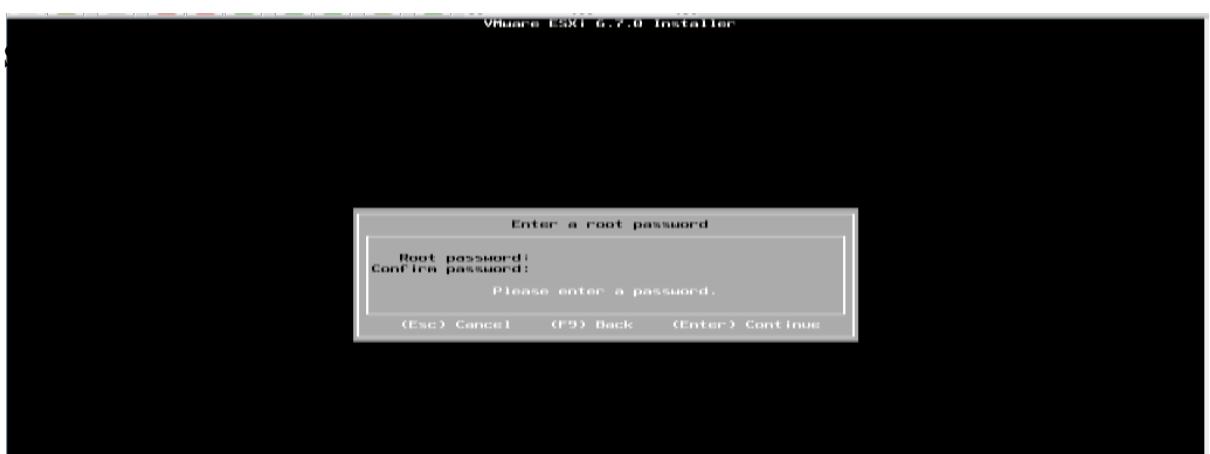
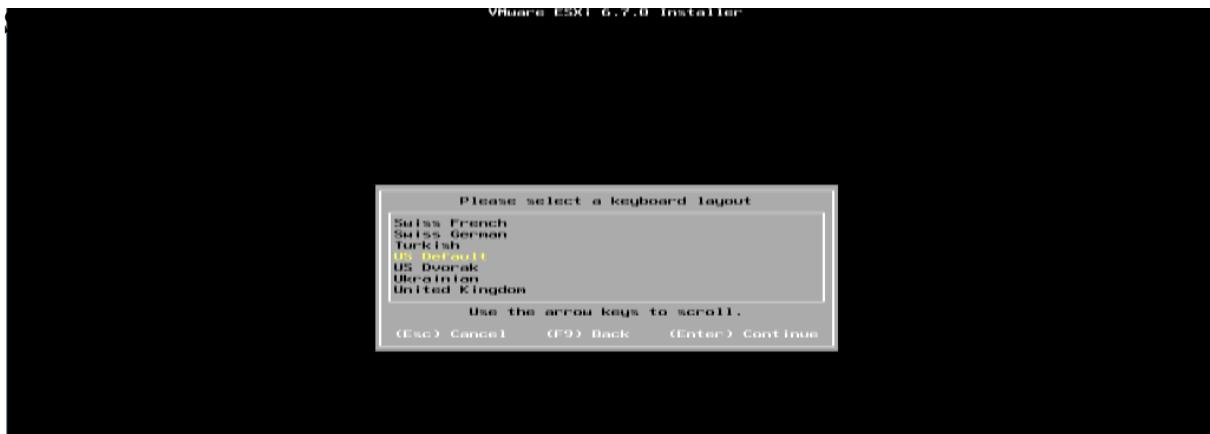
ESXiInstaller:

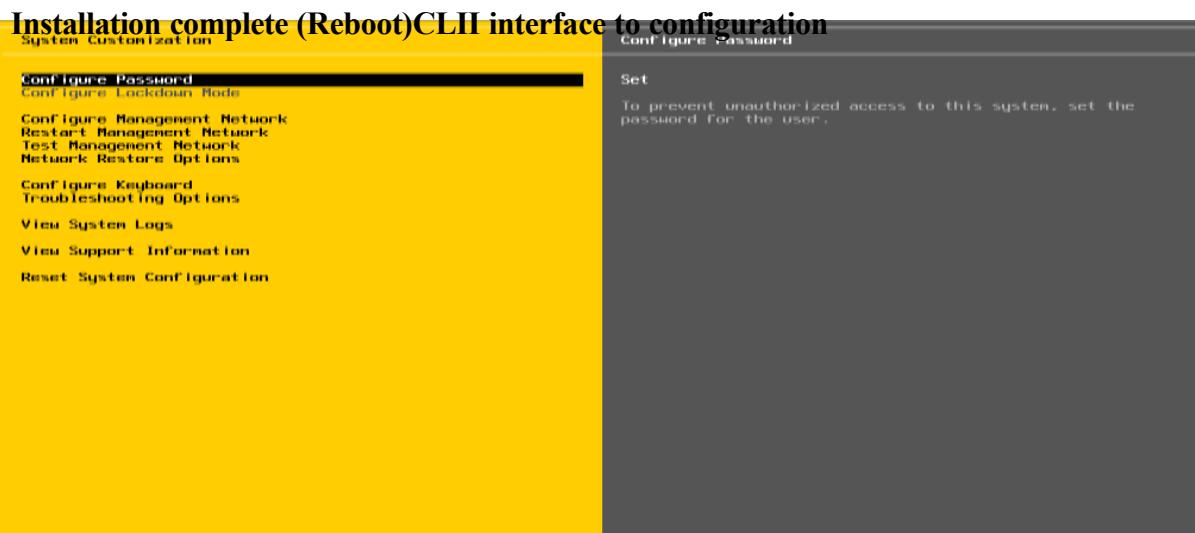
Accept

Agreement:

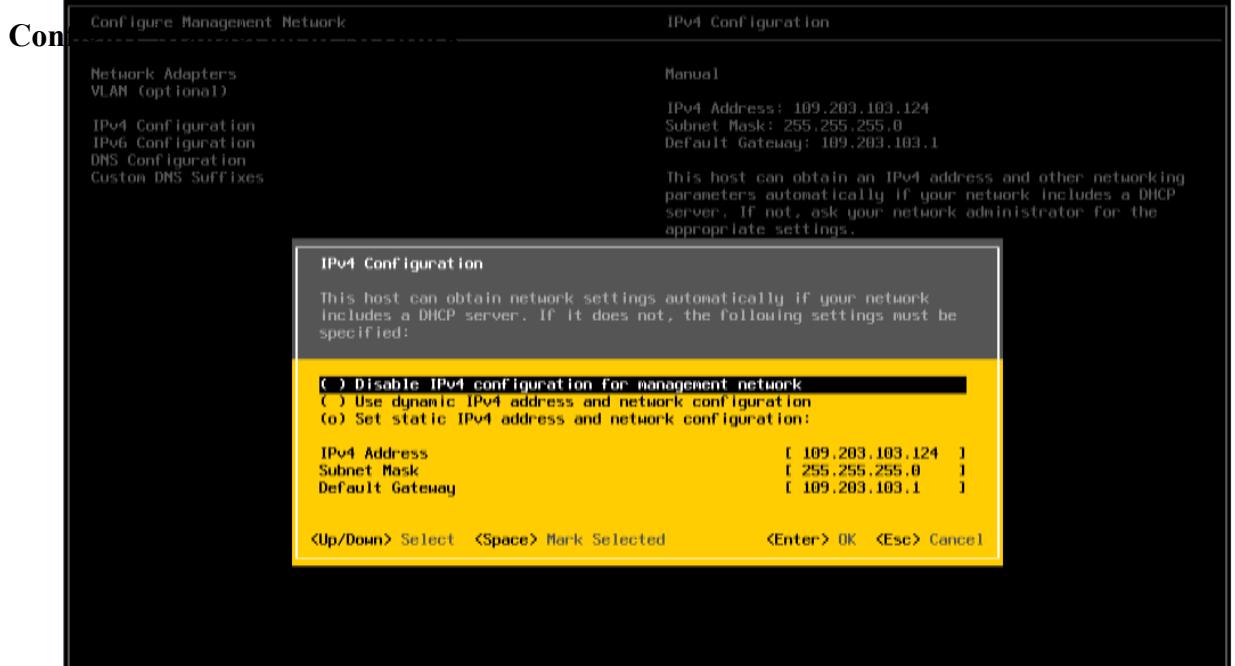


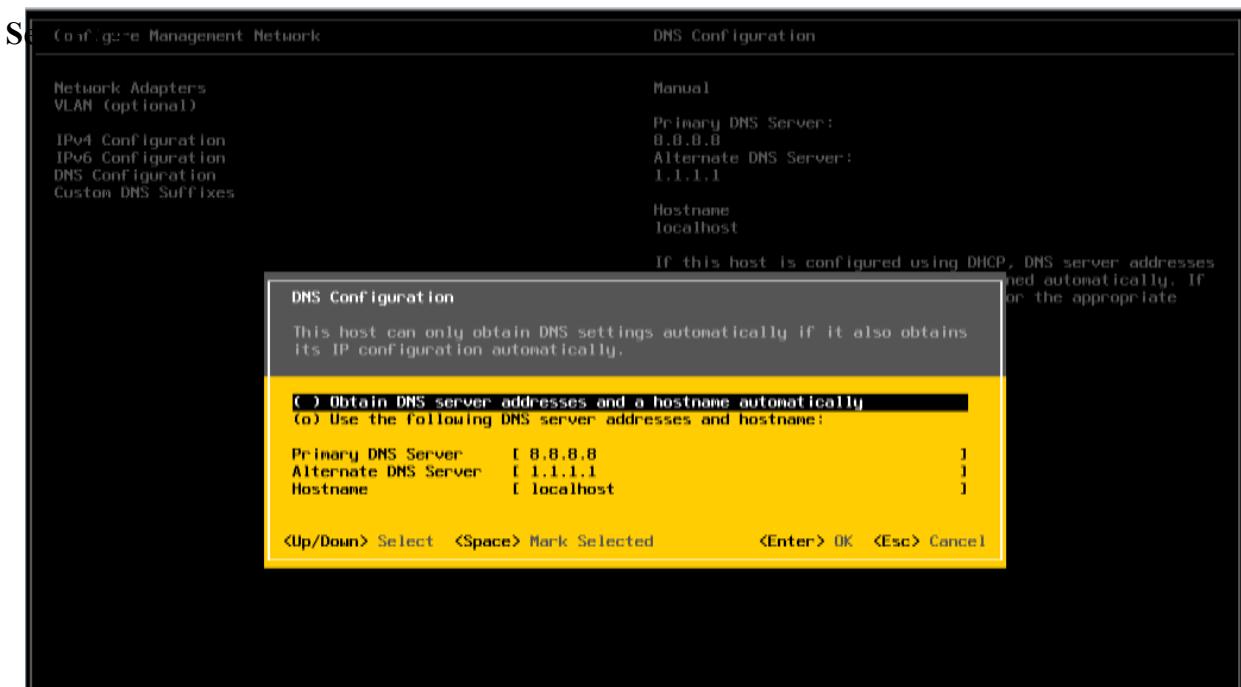
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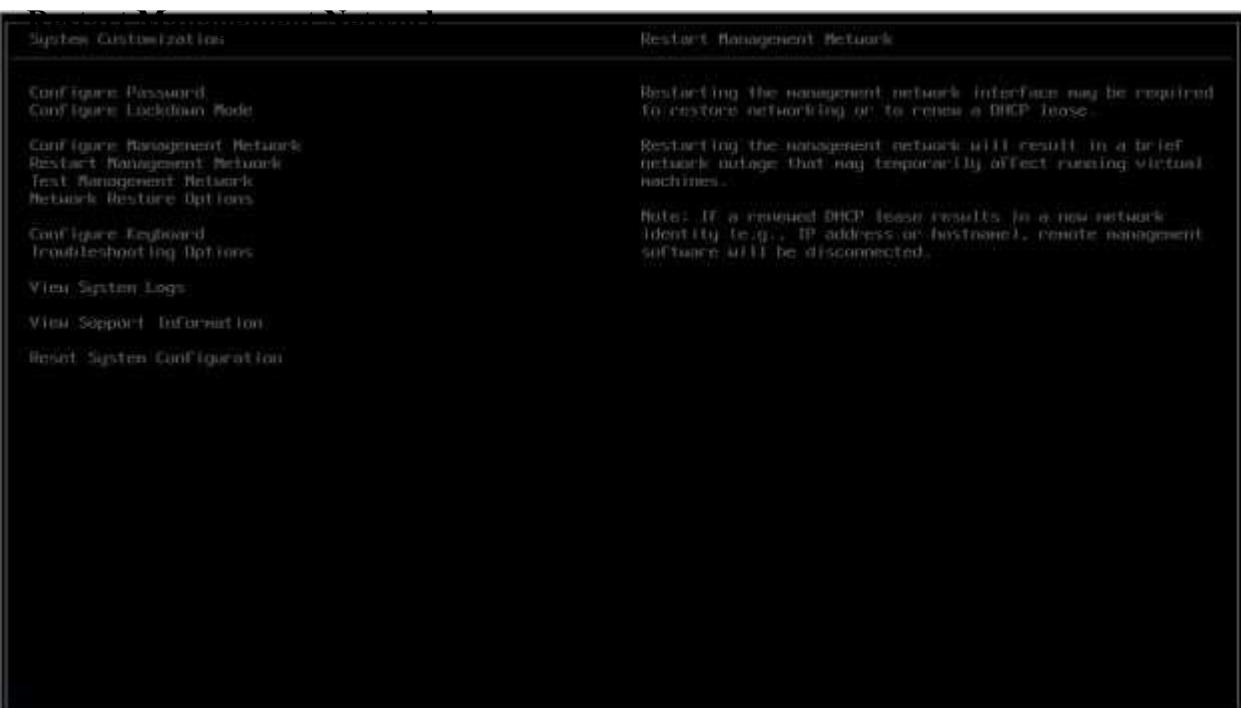


CLI Interface to Configuration:





Set DNServer :



GUIAccess :



ClusterSetup

- **CreatingDatacenter**
- **CreatingCluster**
- **Adding Hosts incluster**
- **Resourcesafteraddingcluster.**
- **DRS**
- **Failover**

VCenter Access:

A screenshot of the vSphere Client interface. The title bar shows the URL https://172.14.5.79/ui/#/extension/vsphere.core/inventory. The main window displays the 'Summary' tab for the datacenter vsphere.avcoe.com. It shows 0 hosts and 0 virtual machines. On the right, resource usage statistics are listed for CPU, Memory, and Storage. Below the summary, sections for 'Recent Tasks' and 'Alarms' are visible. A table of recent tasks shows two entries: 'Remove datacenter' and 'Create datacenter', both completed successfully by the user 'Administrator@VSphere.LOCAL'.

Engineering

Create Datacenter:

The screenshot shows the vSphere Client interface with the URL "vsphere.avcoe.com". In the left sidebar, under "Actions > vsphere.avcoe.com", the "New Datacenter..." option is selected. A modal dialog titled "New Datacenter" is open, prompting for a "Name" (set to "AVOCE") and a "Location" (set to "vsphere.avcoe.com"). The background shows a summary of resources: Virtual Machines: 0, Hosts: 0, CPU: Used: 0 Hz, Capacity: 0 Hz, Memory: Used: 0 B, Capacity: 0 B, Storage: Used: 0 B, Capacity: 0 B. A table of recent tasks is visible at the bottom.

The screenshot shows the vSphere Client interface with the URL "vsphere.avcoe.com". In the left sidebar, under "Actions > AVOCE", the "New Cluster..." option is selected. A modal dialog titled "New Cluster | AVOCE" is open, prompting for a "Name" (set to "AVOCE-CLUSTER"), "Location" (set to "AVOCE"), and cluster settings for "DVS", "vSphere HA", and "EVC". The "Turn On" checkboxes for DVS and vSphere HA are checked, while EVC is set to "Disable". The background shows a summary of resources and a table of recent tasks.

Create cluster :

Assign cluster

name :

This screenshot is identical to the one above, showing the "New Cluster" dialog for creating a cluster named "AVOCE-CLUSTER" in the "AVOCE" location. The "Turn On" checkboxes for DVS and vSphere HA are checked, while EVC is set to "Disable". The background shows a summary of resources and a table of recent tasks.

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Prof. Anand N. Gharu

Add host ::

The screenshot shows the vSphere Client interface. In the center, there is a summary table for the **AVCOE-CLUSTER**. On the left, a sidebar lists recent tasks such as 'Create cluster' and 'Remove cluster'. A context menu is open over the cluster name, with the 'Add Host...' option highlighted. Other options in the menu include 'New Virtual Machine...', 'New Resource Pool...', 'Deploy OVF Template...', 'New vApp...', 'Storage', 'Host Profiles', and 'Edit Default VM Compatibility'. Below the cluster summary, there is a table for 'vSphere DRS' settings.

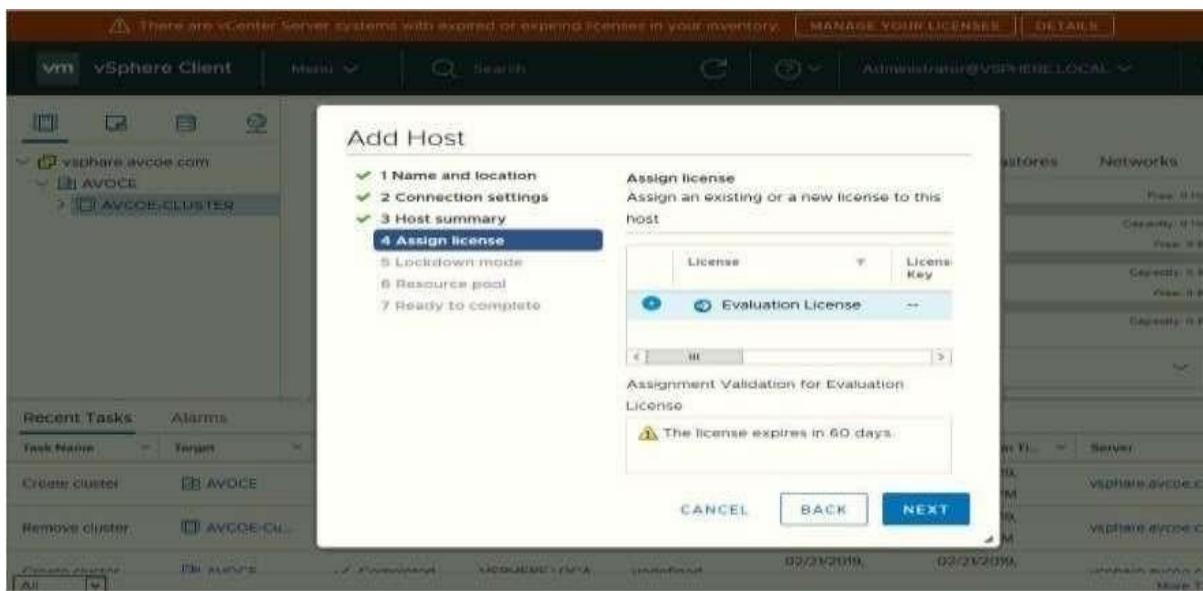
Add host IP ::

This screenshot shows the 'Add Host' wizard in progress. The first step, 'Name and location', is active. It prompts for the host's name or IP address, which is entered as '172.14.5.244'. The location is set to 'AVCOE-CLUSTER'. The background shows the same vSphere Client interface as the previous screenshot, with the 'Add Host...' option still visible in the context menu.

Enter host cre

The screenshot shows the 'Add Host' wizard at step 3, 'Host summary'. It displays a summary of the host's details: Name (172.14.5.244), Vendor (Hewlett-Packard), Model (HP Z420 Workstation), Version (VMware ESXi 6.7.0 build-10302608), and Virtual Machines (0). The background shows the same vSphere Client interface with the 'Add Host...' option in the context menu.

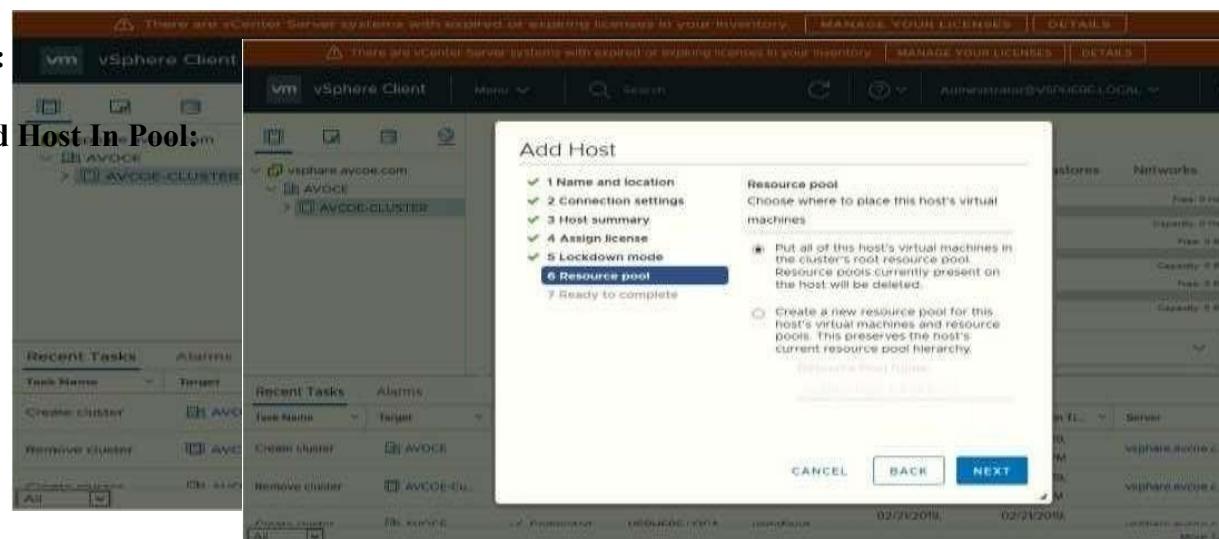
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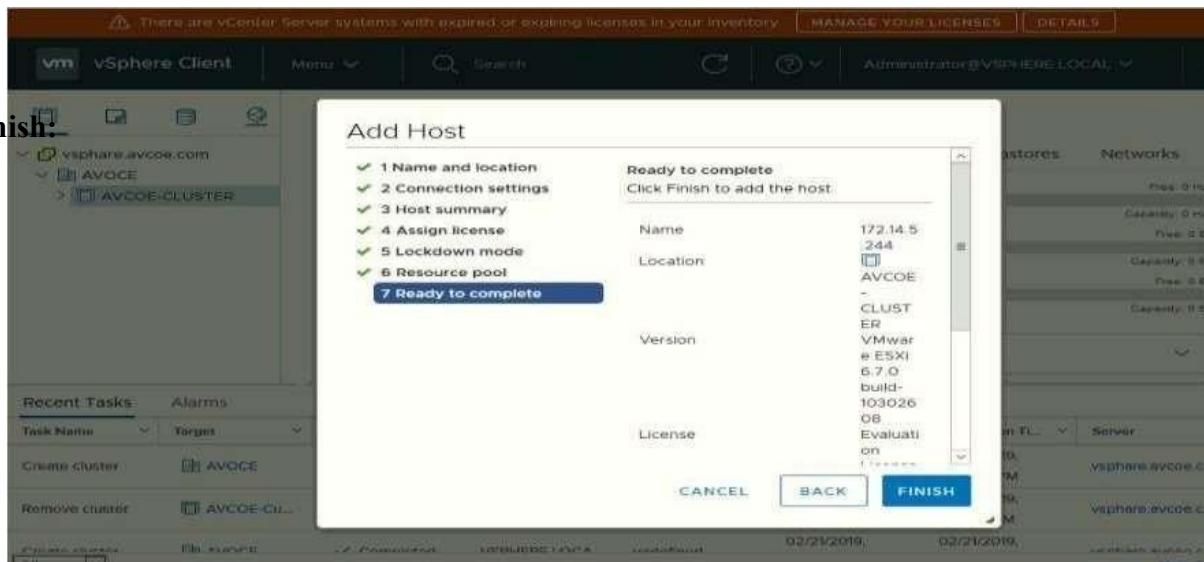
Hot summary :

Lock Down

mode:



Finish:-



Host View and View Config:

Cluster View and Configuration:

Task Name	Target	Status	Initiator	Queued For	Start Time	Completion Time	Server
Configuring vSphere HA	172.14.5.245	✓ Completed	System	156 ms	02/21/2019, 3:04:54 PM	02/21/2019, 3:04:54 PM	vSphere.avcoe.com
Add host	AVCOE-CL...	✓ Completed	VSPHERE.LOCA...	undefined	02/21/2019, 3:04:48 PM	02/21/2019, 3:04:54 PM	vSphere.avcoe.com
Configuring	172.14.5.245	✓ Completed	Custom	84 ms	02/21/2019, 3:04:48 PM	02/21/2019, 3:04:54 PM	vSphere.avcoe.com

Task Name	Target	Status	Initiator	Queued For	Start Time	Completion Time	Server
Configuring vSphere HA	172.14.5.245	✓ Completed	System	156 ms	02/21/2019, 3:04:54 PM	02/21/2019, 3:05:34 PM	vSphere.avcoe.com
Add host	AVCOE-CL...	✓ Completed	VSPHERE.LOCA...	undefined	02/21/2019, 3:04:48 PM	02/21/2019, 3:04:54 PM	vSphere.avcoe.com
Configuring	172.14.5.245	✓ Completed	Custom	84 ms	02/21/2019, 3:04:48 PM	02/21/2019, 3:04:54 PM	vSphere.avcoe.com

Conclusion: Like this we have configure VSphere Private Cloud