CHRIST

(DEEMED TO BE UNIVERSITY)

BANGALORE · INDIA

DEPARTMENT OF

ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DATA SCIENCE

Mini-Project Report

Data Structures

(CSE332P)

B. Tech in Computer Science with spl. in AIML Degree – 3 BTCSAIML C

School of Engineering and Technology,

CHRIST (Deemed to be University),

Kumbalagodu, Bengaluru-560 074

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Certificate

This is to certify that Alicia Theresa Pereira (2462028), Joann Binny (2462088) and Stacy Anna Dsouza (2462156) has successfully completed the Mini Project work for Data Structures – CSE332P in partial fulfillment for the award of Bachelor of Technology during the academic year 2024-2025.

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INDEX

Title of the Project

TRAVEL DESTINATION RECOMMENDATION SYSTEM USING BINARY DECISION TREE

Objective and Relevance:

1. Objective:

The primary objective of this project is to develop a **Travel Recommendation System** using the C programming language. The system utilizes a **binary decision tree** to interactively guide users through a series of personalized questions and preferences—such as climate choice, travel companions, and activity interests—to ultimately provide destination recommendations tailored to the user's input.

Key goals include:

- Implementing a **tree-based structure** to simulate decision-making.
- Practicing **dynamic memory allocation** and **recursive function design**.
- Providing an engaging **command-line interface** that mimics a real-world recommendation engine.

2. Relevance

This project is relevant both in terms of **educational value** and **practical application** in the fields of software development and data-driven systems.

Educational Relevance

- Demonstrates the application of **binary trees**, a core data structure, in a real-world problem.
- Reinforces the use of **functions, structures, and pointers** in C.
- Encourages problem-solving through the implementation of **recursive logic** and **user-driven flows**.

Practical Relevance

- Mimics the logic used in **expert systems** and **recommendation engines**, which are widely used in industries like travel, e-commerce, and entertainment.
- Provides a basic structure that can be expanded into more complex systems, including:
    - GUI-based travel planners
    - Web or mobile applications
    - AI-assisted decision-making tools

Skill Development

- Strengthens understanding of:
    - Input validation
    - Memory management
    - Modular and maintainable code design

- Enhances capability to map logical decision processes into software algorithms.

Concept Applied:

The main concept applied in this project is the use of a Binary Tree data structure to build a travel destination recommendation system.

What is a Binary Tree?

A Binary Tree is a hierarchical data structure where each node has at most two children — referred to as the left and right child. In this project, the binary tree is used to represent a structured set of decision-making questions, with each level guiding the user closer to a final travel destination.

Why Use a Binary Tree in This Project?

- Binary Decision-Making
  Each question asked to the user has exactly two options (e.g., Hot or Cool climate), which fits the left/right branching structure of a binary tree.

- Hierarchical Flow of Questions
  Each level of the tree represents a different category of user preference:

  - Level 1 → Climate (Hot / Cool)
  - Level 2 → Trip Type (Solo / Family)
  - Level 3 → Activity (Adventure / Relaxation / Other)
  - Level 4 → Destination (Leaf Node)

- Efficient Traversal
  The tree allows quick navigation based on user responses, moving step-by-step through the tree until a suitable destination is found.

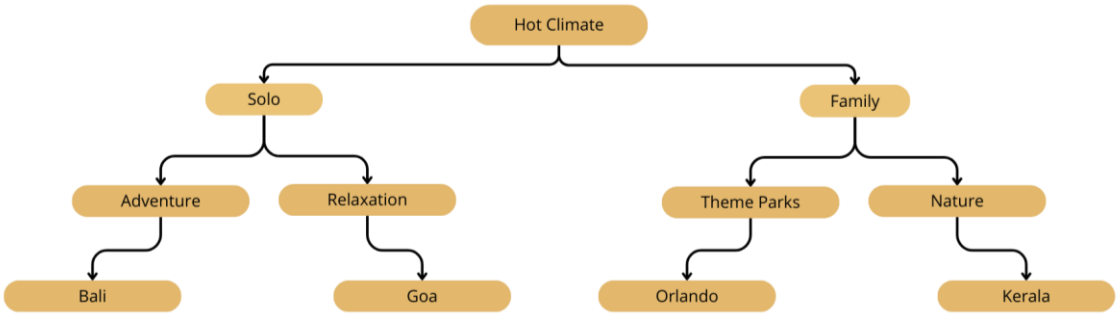
- Easy to Implement in C
  The binary tree structure is simple to implement using structs and pointers in the C programming language, making it ideal for student-level projects.

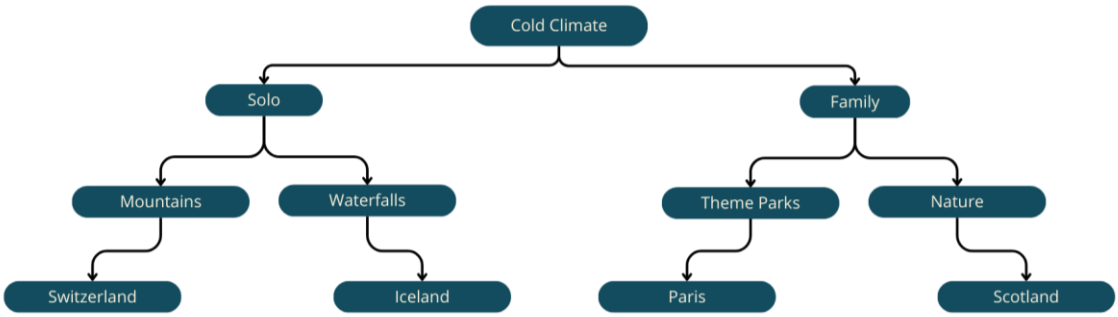
- Practical Real-Life Application
  This project simulates how real-world recommendation systems function by using user input to make logical decisions and return relevant suggestions.

Algorithm:

- Start program.
- Display welcome message (catchphrase + intro lines).
- Ask the first question: Hot (1) or Cool (2) climate.
- If 1 → go to the Hot branch.
- If 2 → go to the Cool branch.
- Ask the second question: Solo/Family (1) or Friends/Work (2).
- Move to the corresponding branch.
- Ask third question:
    - If Solo or Family → Ask: Solo (1) or Family (2).
    - If Friends or Work → Ask: Friends (1) or Work (2).
- Based on group type, ask preference:
    - Adventure (1) or Relaxation (2),
    - or other relevant options depending on previous choices.
- Move deeper into the tree according to user choices.
- Reach a leaf node (final destination recommendation).
- Print travel recommendation with proper formatting.
- Display outro or thank-you message.
- End program.

TREE VISUALIZATION:





Pseudocode of the implementation:

```
START
Display "Welcome to the Travel Recommendation System"
CALL ask(climate)

FUNCTION ask(node)
    IF node is NULL THEN
        RETURN
    ENDIF

    DISPLAY node.text

    IF node.left is NULL AND node.right is NULL THEN
        // It's a recommendation (leaf node)
        DISPLAY "==================================="
        DISPLAY node.text
        DISPLAY "==================================="
        RETURN
    ENDIF

    PROMPT user to enter choice (1 or 2)
    READ choice

    IF choice == 1 THEN
        CALL ask(node.left)
    ELSE IF choice == 2 THEN
        CALL ask(node.right)
    ELSE
        DISPLAY "Invalid choice!"
    ENDIF
END FUNCTION

FUNCTION makeNode(text)
    CREATE newNode
    SET newNode.text = text
    SET newNode.left = NULL
    SET newNode.right = NULL
    RETURN newNode
END FUNCTION
// In main:
CREATE root node for "Climate" question using makeNode
BUILD the binary decision tree with all question and recommendation
nodes
LINK all nodes accordingly (left/right based on options)
CALL ask(root node)
END
```

Program Code:

```c
#include <stdio.h>
#include <stdlib.h>

typedef struct node {
    char text[500];
    struct node *left;
    struct node *right;
} node;

node* makeNode(const char* str) {
    node* temp = (node*)malloc(sizeof(node));
    if (!temp) {
        printf("Memory error!\n");
        exit(1);
    }
    snprintf(temp->text, sizeof(temp->text), "%s", str);
    temp->left = NULL;
    temp->right = NULL;
    return temp;
}

void ask(node* root) {
    if (root == NULL) return;

    if (root->left == NULL && root->right == NULL) {
        printf("\n====================================\n");
        printf("%s\n", root->text);
        printf("====================================\n");
        return;
    }

    int choice;
    printf("\n------------------------------------\n");
    printf("%s", root->text);
    printf("\nEnter choice (1 or 2): ");
    scanf("%d", &choice);

    if (choice == 1) ask(root->left);
    else if (choice == 2) ask(root->right);
    else printf("Invalid choice!\n");
}
```

```
int main() {
    node* climate = makeNode("Choose Climate:\n1. Hot/Tropical\n2.
Cool/Temperate");

    node* hot_group = makeNode("Who are you traveling with?\n1.
Solo/Family\n2. Friends/Work");
    node* cool_group = makeNode("Who are you traveling with?\n1.
Solo/Family\n2. Friends/Work");

    climate->left = hot_group;
    climate->right = cool_group;

    node* hot_solo_or_family = makeNode("Choose:\n1. Solo\n2.
Family");
    node* hot_friends_or_work = makeNode("Choose:\n1. Friends\n2.
Work");
    hot_group->left = hot_solo_or_family;
    hot_group->right = hot_friends_or_work;

    node* cool_solo_or_family = makeNode("Choose:\n1. Solo\n2.
Family");
    node* cool_friends_or_work = makeNode("Choose:\n1. Friends\n2.
Work");
    cool_group->left = cool_solo_or_family;
    cool_group->right = cool_friends_or_work;

    // Hot + Solo
    node* hot_solo = makeNode("Do you prefer:\n1.
Adventure/Activities\n2. Relaxation?");
    hot_solo_or_family->left = hot_solo;

    node* hot_solo_adventure = makeNode("Do you want:\n1. Water
Activities\n2. Land Activities?");
    hot_solo->left = hot_solo_adventure;
    hot_solo_adventure->left = makeNode("Recommended: Bali, Thailand
(Diving/Surfing)");
    hot_solo_adventure->right = makeNode("Recommended: Costa Rica,
Peru (Hiking/Trekking)");

    node* hot_solo_relax = makeNode("Do you want:\n1. Beach\n2. Island
Resort?");
    hot_solo->right = hot_solo_relax;
```

```
    hot_solo_relax->left = makeNode("Recommended: Maldives, Goa (Beach
Relaxation)");
    hot_solo_relax->right = makeNode("Recommended: Santorini, Fiji
(Island Resorts)");

    // Hot + Family
    node* hot_family = makeNode("Do you prefer:\n1. Theme
Parks/Entertainment\n2. Nature/Scenic?");
    hot_solo_or_family->right = hot_family;

    node* hot_family_parks = makeNode("Choose:\n1.
Disney/Universal\n2. Other Parks");
    hot_family->left = hot_family_parks;
    hot_family_parks->left = makeNode("Recommended: Orlando Disney,
Tokyo Disneyland");
    hot_family_parks->right = makeNode("Recommended: Singapore
Universal, Hong Kong Ocean Park");

    node* hot_family_nature = makeNode("Do you prefer:\n1. Beach
Destinations\n2. Mountain/Forest?");
    hot_family->right = hot_family_nature;
    hot_family_nature->left = makeNode("Recommended: Kerala, Hawaii
(Beaches)");
    hot_family_nature->right = makeNode("Recommended: Bali Highlands,
Sri Lanka (Mountains)");

    // Hot + Friends
    node* hot_friends = makeNode("Do you prefer:\n1. Party Vibes\n2.
Adventure/Exploration?");
    hot_friends_or_work->left = hot_friends;

    node* hot_friends_party = makeNode("Do you prefer:\n1. Beach
Party\n2. City Nightlife?");
    hot_friends->left = hot_friends_party;
    hot_friends_party->left = makeNode("Recommended: Ibiza, Phuket
(Beach Parties)");
    hot_friends_party->right = makeNode("Recommended: Bangkok, Miami
(City Nightlife)");

    node* hot_friends_adv = makeNode("Do you want:\n1.
Trekking/Outdoor\n2. Water Sports?");
    hot_friends->right = hot_friends_adv;
```

```
    hot_friends_adv->left = makeNode("Recommended: Thailand Trekking,
Costa Rica Rainforest");
    hot_friends_adv->right = makeNode("Recommended: Philippines
Surfing, Bali Diving");

    // Hot + Work
    node* hot_work = makeNode("Do you want:\n1. Urban City
Experience\n2. Quiet Resort for Workation?");
    hot_friends_or_work->right = hot_work;

    node* hot_work_urban = makeNode("Choose:\n1. Modern Business
Cities\n2. Historic Cities?");
    hot_work->left = hot_work_urban;
    hot_work_urban->left = makeNode("Recommended: Singapore, Dubai
(Modern)");
    hot_work_urban->right = makeNode("Recommended: Miami, Istanbul
(Historic)");

    node* hot_work_resort = makeNode("Choose:\n1. Beach Resort\n2.
Island Retreat?");
    hot_work->right = hot_work_resort;
    hot_work_resort->left = makeNode("Recommended: Bali, Mauritius
(Beach Resorts)");
    hot_work_resort->right = makeNode("Recommended: Maldives,
Seychelles (Island Retreat)");

    // Cool + Solo
    node* cool_solo = makeNode("Do you prefer:\n1. Adventure
(Mountains/Waterfalls)\n2. Relaxation (Lakes/Resorts)?");
    cool_solo_or_family->left = cool_solo;

    node* cool_solo_adv = makeNode("Do you want:\n1. Mountains\n2.
Waterfalls?");
    cool_solo->left = cool_solo_adv;
    cool_solo_adv->left = makeNode("Recommended: Swiss Alps, Nepal
Himalayas (Mountains)");
    cool_solo_adv->right = makeNode("Recommended: Iceland, Norway
(Waterfalls)");

    node* cool_solo_relax = makeNode("Do you want:\n1. Lakes/Scenic
Views\n2. Spa Resorts?");
    cool_solo->right = cool_solo_relax;
```

```
    cool_solo_relax->left = makeNode("Recommended: Canada Rockies,
Norway Fjords (Scenic)");
    cool_solo_relax->right = makeNode("Recommended: New Zealand,
Austria (Spa Resorts)");

    // Cool + Family
    node* cool_family = makeNode("Do you prefer:\n1. Theme Parks\n2.
Nature/Scenic?");
    cool_solo_or_family->right = cool_family;

    node* cool_family_parks = makeNode("Choose:\n1. Disneyland\n2.
Other Parks?");
    cool_family->left = cool_family_parks;
    cool_family_parks->left = makeNode("Recommended: Paris Disneyland,
Tokyo Disneyland");
    cool_family_parks->right = makeNode("Recommended: Legoland
Denmark, Europa Park Germany");

    node* cool_family_nature = makeNode("Do you want:\n1.
Mountains\n2. Countryside?");
    cool_family->right = cool_family_nature;
    cool_family_nature->left = makeNode("Recommended: Switzerland
Alps, Austria (Mountains)");
    cool_family_nature->right = makeNode("Recommended: Scotland,
Ireland (Countryside)");

    // Cool + Friends
    node* cool_friends = makeNode("Do you prefer:\n1. Party
(Festivals/Nightlife)\n2. Adventure (Snow Activities)?");
    cool_friends_or_work->left = cool_friends;

    node* cool_friends_party = makeNode("Do you want:\n1. Summer
Festivals\n2. Nightlife?");
    cool_friends->left = cool_friends_party;
    cool_friends_party->left = makeNode("Recommended: Tomorrowland
Belgium, Glastonbury UK");
    cool_friends_party->right = makeNode("Recommended: Berlin,
Amsterdam (Nightlife)");

    node* cool_friends_adv = makeNode("Do you want:\n1. Mountains\n2.
Snow Sports?");
    cool_friends->right = cool_friends_adv;
```

```
    cool_friends_adv->left = makeNode("Recommended: Nepal, Patagonia
(Mountains)");
    cool_friends_adv->right = makeNode("Recommended: Canadian Rockies,
Swiss Alps (Snow Sports)");

    // Cool + Work
    node* cool_work = makeNode("Do you want:\n1. Urban City
Experience\n2. Quiet Resort for Workation?");
    cool_friends_or_work->right = cool_work;

    node* cool_work_urban = makeNode("Choose:\n1. Major Cities\n2.
Smaller Cities?");
    cool_work->left = cool_work_urban;
    cool_work_urban->left = makeNode("Recommended: London, New York,
Tokyo (Major)");
    cool_work_urban->right = makeNode("Recommended: Vienna, Geneva
(Smaller)");

    node* cool_work_resort = makeNode("Choose:\n1. Mountain
Resorts\n2. Countryside Retreat?");
    cool_work->right = cool_work_resort;
    cool_work_resort->left = makeNode("Recommended: Swiss Alps, Banff
Canada (Mountain Resorts)");
    cool_work_resort->right = makeNode("Recommended: Iceland, Finland
(Countryside Retreat)");

    printf("====================================\n");
    printf("Travel Recommendation System\n");
    printf("====================================\n");
    ask(climate);

    return 0;
}
```

Sample Input/Output Screenshots:

Input/Output 1:

```
====================================
Travel Recommendation System
====================================

------------------------------------
Choose Climate:
1. Hot/Tropical
2. Cool/Temperate
Enter choice (1 or 2): 1

------------------------------------
Who are you traveling with?
1. Solo/Family
2. Friends/Work
Enter choice (1 or 2): 1

------------------------------------
Choose:
1. Solo
2. Family
Enter choice (1 or 2): 1
```

```
------------------------------------
Do you prefer:
1. Adventure/Activities
2. Relaxation?
Enter choice (1 or 2): 2

------------------------------------
Do you want:
1. Beach
2. Island Resort?
Enter choice (1 or 2): 2

====================================
Recommended: Santorini, Fiji (Island Resorts)
====================================
```

Input/Output 2:

```
====================================
Travel Recommendation System
====================================

------------------------------------
Choose Climate:
1. Hot/Tropical
2. Cool/Temperate
Enter choice (1 or 2): 1

------------------------------------
Who are you traveling with?
1. Solo/Family
2. Friends/Work
Enter choice (1 or 2): 1

------------------------------------
Choose:
1. Solo
2. Family
Enter choice (1 or 2): 2
```

```
------------------------------------
Do you prefer:
1. Theme Parks/Entertainment
2. Nature/Scenic?
Enter choice (1 or 2): 2

------------------------------------
Do you prefer:
1. Beach Destinations
2. Mountain/Forest?
Enter choice (1 or 2): 1

====================================
Recommended: Kerala, Hawaii (Beaches)
====================================
```

Input/Output 3:

```
====================================
Travel Recommendation System
====================================

----------------------------------
Choose Climate:
1. Hot/Tropical
2. Cool/Temperate
Enter choice (1 or 2): 2

----------------------------------
Who are you traveling with?
1. Solo/Family
2. Friends/Work
Enter choice (1 or 2): 2

----------------------------------
Choose:
1. Friends
2. Work
Enter choice (1 or 2): 1
```

```
----------------------------------
Do you prefer:
1. Party (Festivals/Nightlife)
2. Adventure (Snow Activities)?
Enter choice (1 or 2): 2

----------------------------------
Do you want:
1. Mountains
2. Snow Sports?
Enter choice (1 or 2): 2

====================================
Recommended: Canadian Rockies, Swiss Alps (Snow Sports)
====================================
```

Input/Output 4:

```
====================================
Travel Recommendation System
====================================

------------------------------------
Choose Climate:
1. Hot/Tropical
2. Cool/Temperate
Enter choice (1 or 2): 2

------------------------------------
Who are you traveling with?
1. Solo/Family
2. Friends/Work
Enter choice (1 or 2): 2

------------------------------------
Choose:
1. Friends
2. Work
Enter choice (1 or 2): 2
------------------------------------
Do you want:
1. Urban City Experience
2. Quiet Resort for Workation?
Enter choice (1 or 2): 1

------------------------------------
Choose:
1. Major Cities
2. Smaller Cities?
Enter choice (1 or 2): 2

====================================
Recommended: Vienna, Geneva (Smaller)
====================================
```

Result:

The Travel Recommendation System was successfully implemented using the C programming language with a binary tree structure to represent a decision-making process. Upon execution, the program:

- Displays a welcome message to introduce the system.
- Prompts the user with a series of multiple-choice questions related to:
    - Climate preference (Hot or Cool),
    - Travel group type (Solo, Family, Friends, or Work),
    - Personal interests (Adventure, Relaxation, Entertainment, etc.).
- Traverses a binary tree based on user input, guiding them step-by-step through the decision path.
- Presents a final travel destination recommendation at the leaf node based on the user's choices.

Conclusion:

The Travel Recommendation System project demonstrates the practical application of **binary trees** in a real-world decision-making scenario. The system guides the user through a structured series of questions and uses their responses to navigate through the tree, ultimately arriving at a personalized travel destination suggestion.

The project fulfills its primary objectives:

- It provides an interactive and user-friendly experience.
- It applies fundamental C programming concepts such as structures, dynamic memory allocation, recursion, and input handling.
- It models a simplified version of recommendation systems used in modern travel platforms.

This project serves as a foundational implementation that can be further extended by integrating more features such as:

- File input/output for dynamic tree creation,
- Graphical user interface (GUI),
- Database or API connectivity,
- Support for more than two options per question (multi-way decision trees).

In conclusion, the system is a successful demonstration of how logical decision trees can be applied to create useful, interactive tools that assist users in personalized decision-making.

References:

- C Programming Language — Kernighan & Ritchie
- GeeksforGeeks (Binary Trees, Recursion examples)
- TutorialsPoint (C Pointers and Structures)