

**WIA1002 DATA STRUCTURE
SEMESTER 2, SESSION 2023/2024**

**GROUP PROJECT
TOPIC 6: NBA General Manager**

1.0 Background



Figure 1: Welcome to the NBA

The NBA, America's premier professional basketball league, showcases the world's elite athletes across its 10 teams. The San Antonio Spurs stand out for their illustrious history and commitment to excellence. Established in 1967, the Spurs have become synonymous with success, particularly during their golden years in the late 1990s and early 2000s.



Figure 1.1: The San Antonio Spurs Big Three

Under the astute leadership of Coach Greg Popovich and featuring a legendary lineup including Tim Duncan, Manu Ginobili, and Tony Parker, the Spurs were a dominant force, clinching four championships and setting high standards of sportsmanship.

2.0 Problem Statement



Figure 2 : The NBA General Manager

However, times have changed. Following the retirement of iconic figures like Duncan and Ginobili, the Spurs have encountered a series of setbacks. During these challenging times, your longstanding dedication to the Spurs remains unshaken. Despite the team's struggles, your passion for basketball and deep understanding of the game inspire you to step forward. Seizing the opportunity, you decide to apply for the role of General Manager (GM). Against all odds, your innovative approaches and fervent love for the sport distinguish you from global candidates, culminating in your selection for this pivotal role.



Now, as the new GM of the San Antonio Spurs, you are tasked with a monumental mission: to rebuild and restore the team to its former glory, transforming it once again into an NBA powerhouse.

3.0 Basic Requirements (12 marks)

3.1 Build a championship contender team (1 mark)

In professional basketball, particularly the NBA, a well-structured and talented roster is essential for a team's success. As the General Manager of the San Antonio Spurs, your primary responsibility is to build a winning team. The free agent market is a platform where you can find and acquire talented players. Your roster is currently empty, and you have the opportunity to select players from the following list, as listed below :

Free Agent Market :

Name	Profile	Average Statistics Per Game
LeBron James 	Age : 39 Height : 2.01m Weight : 113kg Position : Forward Salary : 2500	Points : 25.6 Rebounds : 8.0 Assists : 7.2 Steals : 1.2 Blocks : 0.2
Stephen Curry 	Age : 35 Height : 1.93m Weight : 90kg Position : Guard Salary : 2000	Points : 20.6 Rebounds : 5.0 Assists : 6.2 Steals : 1.2 Blocks : 0.2
Kevin Durant 	Age : 35 Height : 1.93m Weight : 90kg Position : Forward Salary : 2500	Points : 21.6 Rebounds : 8.0 Assists : 9.2 Steals : 1.2 Blocks : 0.2
Jarret Allen	Age : 35	Points : 7.6 Rebounds : 14.0

	Height : 1.93m Weight : 90kg Position : Center Salary : 500	Assists : 1.2 Steals : 1.2 Blocks : 0.2
Luka Doncic 	Age : 21 Height : 1.98m Weight : 103kg Position : Guard Salary : 3500	Points : 27.6 Rebounds : 8.0 Assists : 11.2 Steals : 1.2 Blocks : 0.2

Note :

The data provided above is for reference purposes only, it is your own choice to use it.
For more player details, you may refer to the official NBA website (Assume all players are free agent) :

Get All NBA Player :

<https://www.nba.com/players>

Get a specific NBA Player :

<https://www.nba.com/player/1628386/jarrett-allen>

You have great understanding of building a championship roster, but there are a few regulations that you have to follow, officially stated as below :

Rules

NBA Team Composition Rules

1. Team Size Regulations

- Minimum Players: Each team must consist of a minimum of ten (10) players.
- Maximum Players: Each team must not exceed fifteen (15) players at any given time.

2. Positional Requirements

- Guards: Each team is required to have a minimum of two (2) players classified as Guards.
- Forwards: Each team must have at least two (2) players classified as Forwards.
- Centers: Each team is obligated to maintain a minimum of two (2) players classified as Centers.

3. Salary Cap Limitations

- Total Salary Cap: Each team is subject to a total salary cap of \$20,000. This cap must not be exceeded under any circumstances.
- Salary Allocations: Should a team consist of nine (9) players with a total combined salary of \$19,000, the team may only recruit additional players whose salary does not exceed \$1,000.

4. Contractual Salary Guidelines

- Superstar Players: Players who have averaged more than 20.0 points per game in the 2023-2024 season are designated as superstar players. The minimum salary for superstar players is set at \$3,000.
- Non-Superstar Players: All other players are classified as non-superstar players. The minimum salary for these players is established at \$1,000.

5. Considerations

This is not a rule, but some suggestions. As a general manager, you have a deep understanding of forming a basketball team. Team chemistry, offense, defense are key factors contributing to the overall winning of the team. Take these factors when considering your recruitment. Best of luck!

3.2 Add Player (1 mark) :

You have scouted a great forward player, LeBron James, a.k.a 'The Goat' (Greatest of All Time) from the free agent market who shows great potential. You planned to recruit him to play for your team. If the addition of the player would break the rules, the operation should be disallowed and display appropriate messages. Remember, strategic foresight and adherence to NBA team composition rules are key to forming a successful team. Print the team roster after the addition.

3.3 Remove Player (1 mark):

Your center, Kevin Durant, has been inconsistent for the past 20 games. In addition, he had injury issues. After careful consideration, the decision has been made to release him. Ensure that removing him does not violate the rules. Print the team roster after the removal.

*** After any addition or removal of a player, your system should automatically validate the entire roster to ensure compliance with the NBA's team composition rules and respond with appropriate messages.*

3.4 Dynamic Searching (2 marks):

In the high-stakes environment of an NBA final, where the intensity and pace of the game significantly escalate, a coach may not always recall every detail of each player's physical attributes and skills.

Imagine our team is trailing by four points, you need to find a player on your team who's tall like Kevin Durant, with similar body weight, same position and plays great defense to guard him effectively.

A dynamic searching indicates an advanced search function with multiple search attributes, as shown in the example below :

Find attributes : Height,>=,2.0,Weight,<=,150kg,Position,-,Forward

Player List :

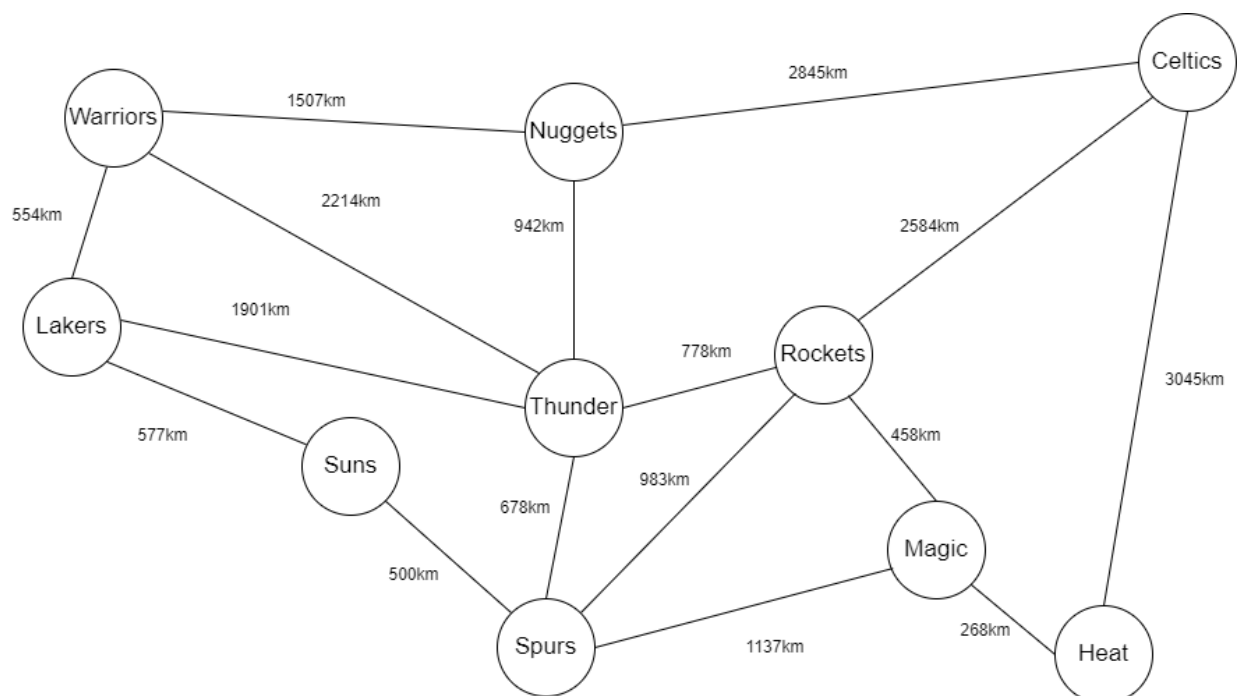
Name	Age	Height	Weight	Position	Salary	Points	Rebounds	Assists	Steals	Blocks
Lebron James	39	2.01	113	Forward	1200	25.6	8.0	7.2	1.2	0.2

If no record is found, return a message indicating no players found.

3.5 Construct the NBA cities (1 mark)

The NBA consists of ten teams, each located in distinct cities across the United States.

No.	City	Team Name
1.	San Antonio (Your team)	Spurs
2.	Golden State	Warriors
3.	Boston	Celtics
4.	Miami	Heat
5.	Los Angeles	Lakers
6.	Phoenix	Suns
7.	Orlando	Magic
8.	Denver	Nuggets
9.	Oklahoma City	Thunder
10.	Houston	Rockets



With the NBA organization's provided map, you have a glance of the overview of all the cities that have an NBA team. Then, you need to create a digital model that accurately represents these cities and their distances in your system.

3.6 Crafting the Journey (2 marks)

As the General Manager of the San Antonio Spurs, you are tasked with planning the optimal travel schedule for the upcoming NBA season. Your goal is to minimize total travel distance, enhancing your team's overall performance.

Use graph traversal algorithms to plan potential schedules starting from San Antonio, the home of the Spurs. The main goal is to find the most efficient travel route for the season.

Ensure that your team visits each city mentioned in the graph, starting from the San Antonio Spurs. There's no requirement to end the journey in any specific city, as the location of the final game will signify the season's end. You need to find out the total distance your team travels with each algorithm, measured in kilometers, and explain why you chose a specific route.

Here are the algorithms you can use, but not limited to :

- Breadth-First Search
- Depth-First Search

In the end, list the cities in the order you visited them and the total distance traveled. Explain why the chosen travel plan is the best.

3.7 Injury Reserve Management (1 mark):

During the season, injuries are an unfortunate reality in professional basketball. As the General Manager, you need to implement a system to manage injured players effectively. Your stack should allow you to add players to the injury reserve when they are injured and remove them when they are fit to play again. Your program should also be able to display the list of injured players. For example one of your star players, LeBron James, suffers a sprained ankle during a crucial game. You need to quickly add him to the injury reserve and monitor his recovery progress. Once he is cleared to play, you should be able to remove him from the injury reserve and add him back to the active roster. Here's an output example:


```
-- Adding Player to Injury Reserve --  
Player: LeBron James  
Injury: Sprained Ankle  
Status: Added to Injury Reserve  
  
-- Removing Player from Injury Reserve --  
Player: LeBron James  
Status: Cleared to Play
```

3.8 Contract Extension Queue (1 mark):

As the end of the season approaches, managing contract extensions becomes a critical task for the General Manager. Consider a scenario where your star player, Stephen Curry, has led the team to a successful season with his exceptional performance on the court. As his contract expiration date looms, there is a growing anticipation among fans and management about his future with the team.

To manage this situation effectively, you need to implement a queue to manage players in line for contract negotiations. You should add Stephen Curry to the contract extension queue, prioritizing negotiations based on his outstanding performance. As other players' contracts are resolved, you should be able to remove them from the queue and focus on negotiating with Stephen Curry's representatives.

```
-- Adding Player to Contract Extension Queue --  
Player: Stephen Curry  
Status: Added to Contract Extension Queue  
  
-- Removing Player from Contract Extension Queue --  
Player: Stephen Curry  
Status: Contract Renewed
```

3.9 Player Performance Ranking (2 marks):

As the General Manager, you need to implement an advanced sorting algorithm to evaluate player performance and make informed decisions about team strategy.

Consider a scenario where you are preparing for a crucial game against a tough opponent. Your team's success hinges on selecting the best lineup based on player performance.

Your sorting algorithm should rank players based on various performance statistics, including average points scored per game, rebounds, steals, assists, and blocks. To add complexity, introduce the concept of weighting these criteria differently based on the player's position. For example, a Center's performance in rebounds and blocks might be weighted more heavily than a Guard's, while a Guard's performance in assists and steals might be weighted more heavily.

The sorting algorithm should calculate a composite performance score for each player, considering these weighted criteria, and rank them in descending order of this composite score. This ranking will provide you with valuable insights into each player's contribution to the team and help you make strategic decisions about player rotations and lineup selections for the upcoming game.

```
-- Player Performance Ranking --  
Player: LeBron James  
Composite Score: 92.5  
Rank: 1  
  
Player: Stephen Curry  
Composite Score: 88.3  
Rank: 2  
  
Player: Kevin Durant  
Composite Score: 84.7  
Rank: 3
```

4.0 Extra Features (4 marks)

This section requires you to implement things that might be beyond your learning syllabus. You are encouraged to explore one or more of these features. Completing the extra feature(s) will grant you extra mark(s), and make your program stand out among your peers. You're encouraged to try more than one, if possible, to maximize your learning outcome.

I. GUI

Try to design and implement a Graphical User Interface (GUI) that allows the interaction of the users. If you are looking for something more challenging, you can even create an animation to simulate the graph traversal!

II. Database

Implement a database to store your roster, schedule, injury reserve stack, and contract Extension Queue, avoiding the need to store everything in the computer's memory.

III. NBA API Integration

As mentioned in Task 1, you can recruit players from the free-agent market. However, it is tedious to enter all the current active players in the NBA and insert them into the database.

You may refer to this documentation for efficient fetching of all current NBA players for you to recruit in the free agent market.

<https://www.balldontlie.io/#introduction>

IV. Think out of the box

Sky is your limit. Wishing you all the best as you try out anything that catches your interest.

5.0 Others

Kindly refer to the assignment instruction and marking rubrics for more information

5.1 Tips

Here are some tips to help you in completing this assignment:

- Use code management tools such as Github to manage you and your teammates' code
- Leave no man behind ! Always plan the work to be distributed equally among team members

5.2 Enquiries

If you have any questions related to the topic, please contact us :

1. Module 3.0 - 3.6 :

Name : Zheng Wu Bang

Email : s2132122@siswa.um.edu.my

2. Module 3.7 - 3.9:

Name : Nafees Sadat

Email : s2121003@siswa.um.edu.my