Artificial Intelligence & Its Applications

Laboratory 02

Submission Due: 26-May-2023

Submission Procedure:

1. Use Pickle to **save all answer variables of each question** into a file named " Variables_Q1/2/3/4.pkl"
2. **Save the code of each question** into a file named "Code_Q1/2/3/4.py"
3. **Write a experimental report** which includes key code with annotation, experimental result, and solution ideas/harvest/summary of each question named "Report_XX_YY.pdf"
4. Compress the above 9 files into a file named "Lab02_XX_YY.zip"
5. Send "Lab02_XX_YY.zip" to your monitor with title "AI: Lab02_XX_YY".

   XX is your student ID.
   YY is your first name + last name in small letter without spacing.

   For example:
   Chen Tao and ID 20190123456789
   The file names should be
   "Lab02_20190123456789_chentao.zip"

Networkx in Python is used in Q1 and Q2 of this laboratory.

Networkx
https://networkx.github.io

Installation
Command: "`pip install network`"

Graph Creation
https://networkx.github.io/documentation/stable/tutorial.html#creating-a-graph

Directed Graph Creation
https://networkx.github.io/documentation/stable/reference/classes/digraph.html?highlight=digraph#networkx.DiGraph

BFS and DFS
https://networkx.github.io/documentation/stable/reference/algorithms/traversal.html?highlight=bfs#

Shortest Path Algorithm
https://networkx.github.io/documentation/stable/reference/algorithms/shortest_paths.html

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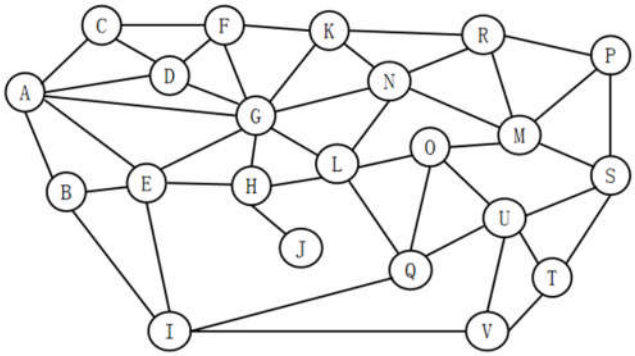
minimax and **gym** in Python are used in Q3 and Q4 of this laboratory. For detail, please refer to Lab2_sup.pdf

Q1. i) Store the following graphs in the format of Networkx.

ii) Show the sequence of visited edges using DFS and BFS for the graph starting at node A.

iii) Find the cost of the shortest path from node A to all nodes.

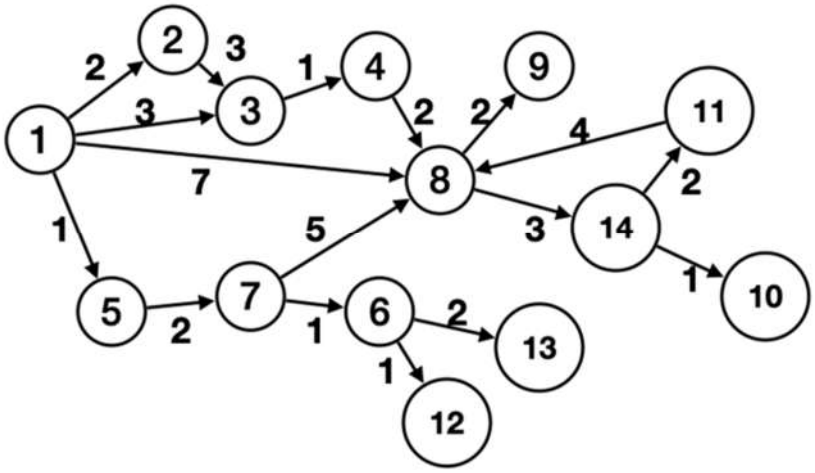


Answer Requirement:

1. Draw the graph and Save the variable of the model using Pickle in **`Q1_i`**
2. Show and Save the sequences in **`Q1_ii_DFS`**, **`Q1_ii_BFS`** in this format:

   `[('A', 'B'), ('A', 'C'), ('A', 'D'), …]`
3. Show and Save answer in **`Q1_iii`** in the format: `[('A', 10), ('B', 20), …]`

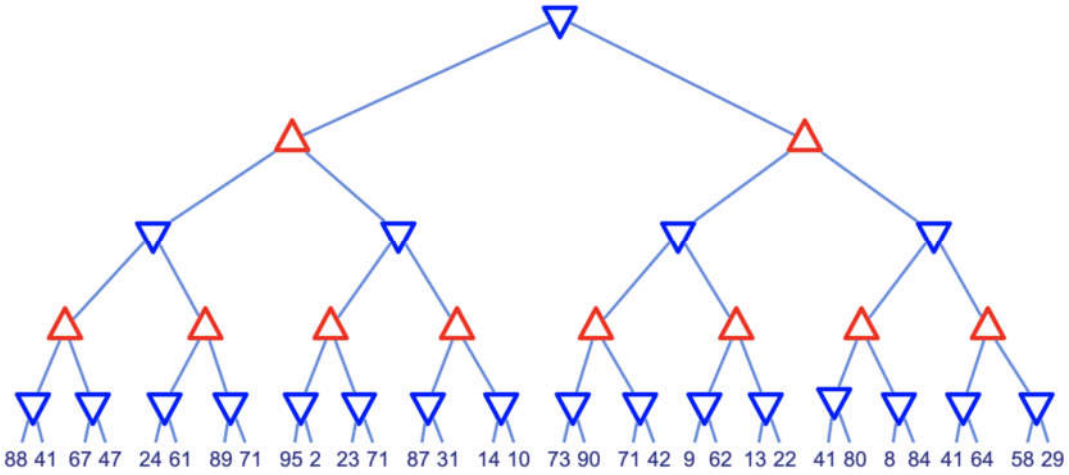
Q2. Given the following graph, the weight of each edge represents the delay time of signal transmission. If we send a signal from node 1, what's the minimum time required for all nodes to receive the signal? If it's impossible, return -1.



Answer Requirement:

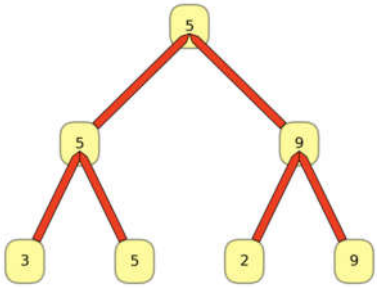
- Show and Save the answer in **Q2** in the format: `[(1, 10), (2, 20), …]`

Q3. Consider a game which has 2^n final states and paths to reach final state are shown in the following complete binary tree. Find the values of all non-leaf nodes in the tree.



Answer Requirement:

- Visualize and Save your tree in **Q3** in the tree format of *minimax* library. Be noted that the tree format is a **BiTree** object, and can be visualized by **tree.view_in_graph()**



Q4. A and B are playing a game. There are N coins at the beginning, and a player can pick 7 or 4 or l coins in each move. A always starts the game. The player who picks the last coin wins the game. Assume the strategy of both are minimax.

i) Who will win the game when N = 100?

ii) When N is from 0 to 200, in which cases A will win?

Answer Requirement:

1. Show and Save the answer in **`Q4_i`** in this format: A
2. Show and Save the sequences in **`Q4_ii`** in this format: `[0, 1, 0, 1, …]`

   Note: Set list[0] = 0 because N=0 is nonsense. list[i]=1 represents A will win if N=i, $1 \leq i \leq 200$. The list contains 201 elements in total.