Middle East Technical University | Department of Computer Engineering

CENG 462

Artificial Intelligence

Spring 2023-2024

Assignment 1

Regulations

1. The homework is due by **23:55 on March 24th, 2024**. Late submission is not allowed.
2. Submissions are to be made via ODTUClass, do not send your homework via e-mail.
3. You can use any typesetting tool (LaTex, Word, etc.) or handwriting while typing/writing your answers. However, your answer must be clearly writen and easily readable.
4. Upload your answers as a single **pdf** file named *yourStudentId_HW1.pdf*. **Submissions that violate the naming convention will incur a grade reduction of 10 points.**
5. Send an e-mail to **garipler@metu.edu.tr** if you need to get in contact.
6. **This is an individual homework, which means you have to answer the questions on your own. Any contrary case including but not limited to getting help from automated tools, sharing your answers with each other, extensive collaboration etc. will be considered as cheating and university regulations about cheating will be applied.**

Question 1 (65pts)

Given the undirected graph G_1 such that $G_1 = (V_1, E_1)$ where
$V_1 = \{A, B, C, D, E, F, G, H, I, J, K, L\}$ and
$E_1 = \{(A, B), (A, C), (A, D), (B, H), (B, D), (C, E), (D, J), (H, I), (H, J), (I, E), (E, F), (F, K), (F, L), (F, G), (K, L), (G, L)\}$;

a) Apply depth first search to reach the goal node G from the initial node A. Give the resulting search tree and the order of nodes visited (from the very beginning to the end). *(30pts)*

b) Apply iterative deepening depth first search to reach the goal node G from the initial node A. Start from the initial depth limit of 3. For each iteration, give the order of nodes visited (from the very beginning of the iteration to its end). Also provide the the resulting search tree for the last iteration. *(35pts)*

Important Remark: While deciding the order of neighbour nodes (of a current node) to branch, do not follow any random or guessed(!) order. Instead, follow the order imposed by the formal definition of G_1. To illustrate, from the node is A, you must first branch to B, then C, then D since the order of related edges in E_1 is $(A, B), (A, C), (A, D)$. Similarly, from the node D, you must first branch to B, then J since the order of related edges in E_1 is $(B, D), (D, J)$.

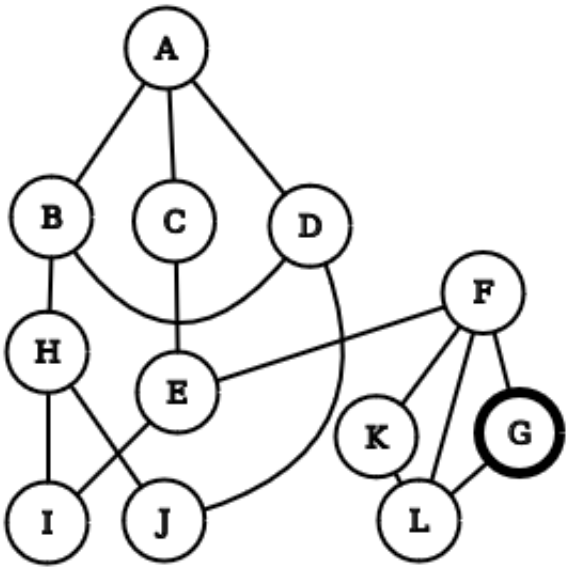

Figure1. G_1

Question 2 (35pts)

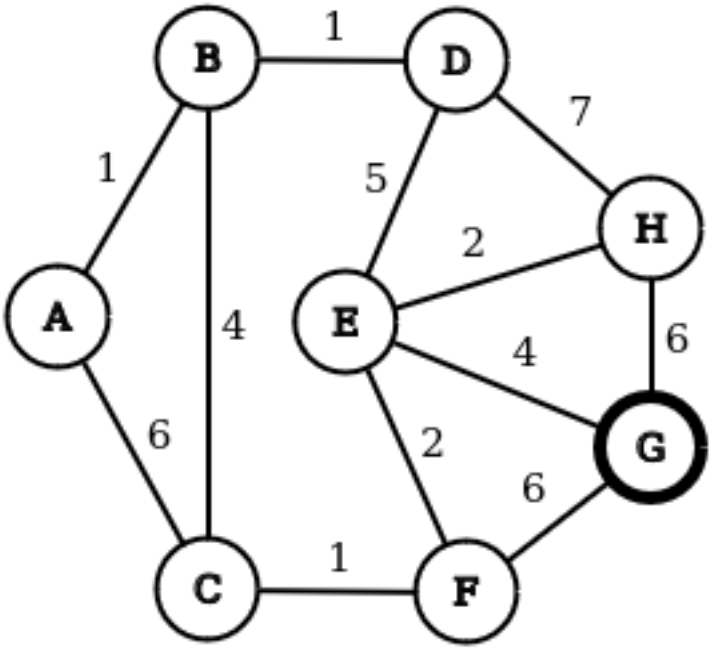

Figure1. G_2

Given the undirected weighted graph G_2 such that $G_2 = (V_2, E_2, c)$ where

$V_2 = \{A, B, C, D, E, F, G, H\}$,

$E_2 = \{(A, B), (A, C), (B, C), (B, D), (C, F), (D, E), (D, H), (E, F), (E, G), (E, H), (F, G), (G, H)\}$,

and the cost function c is as such:

$c = \{(A, B) \to 1, (A, C) \to 6, (B, C) \to 4, (B, D) \to 1, (C, F) \to 1, (D, E) \to 5, (D, H) \to 7,$
$(E, F) \to 2, (E, G) \to 4, (E, H) \to 2, (F, G) \to 6, (G, H) \to 6\}$

Apply uniform cost search to reach the goal node G from the initial node A. Give the resulting search tree, the resulting path (from A to G), the order of nodes visited (from the very beginning to the end). Also provide the fringe at each step (i.e. after each node expansion / branching). Your fringe should be a priority queue and at each step should arrange itself accordingly.