EXAM OF FUNDAMENTALS OF AI – FIRST MODULE
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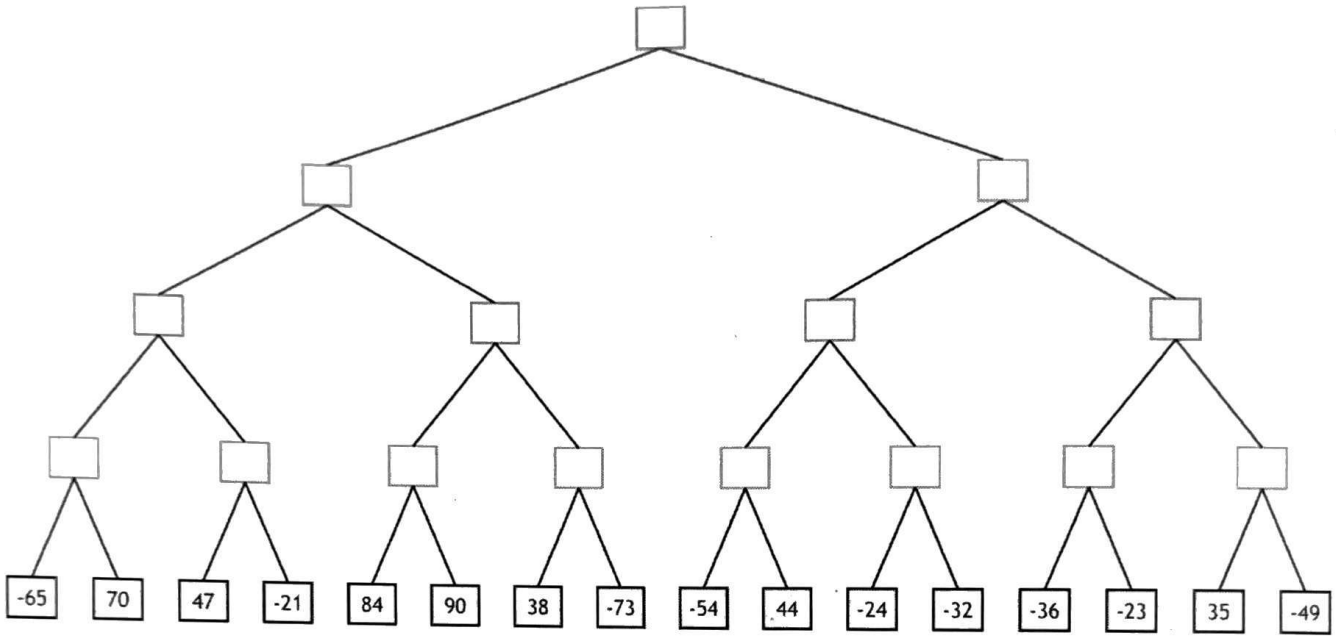
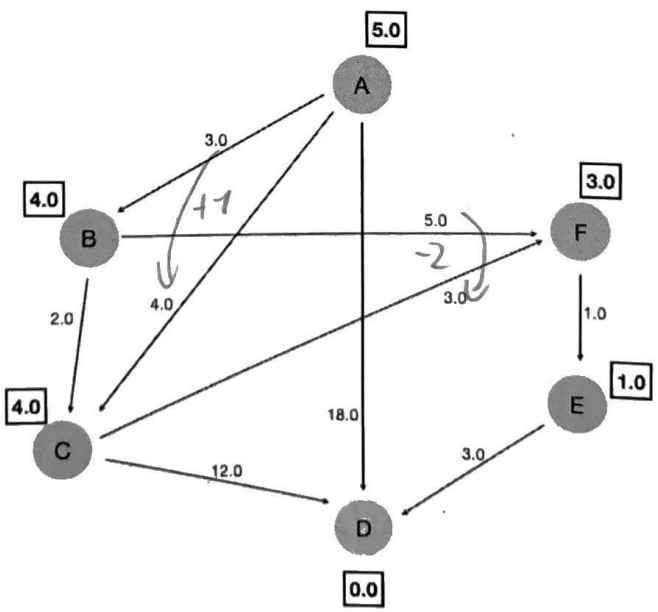
Exercise 1

Consider the following game tree where the first player is MAX. Show how the min-max algorithm works and show the alfa-beta cuts. Also, show which is the proposed move for the first player.



Exercise 2

Consider the following graph, where A is the initial node and D the goal node. The number on each arc is the cost of the operator for the move, while the number in the square next to each node is the heuristic evaluation of the node itself, namely, its estimated distance from the goal.



a) Apply the depth-first search (do not consider the costs of the nodes), and draw the developed search tree indicating the expansion order; in the case of non-determinism, choose the nodes to expand according to the alphabetical order. What is the produced solution and its cost?
b) Apply search A*, and draw the developed search tree indicating the expansion order and the value of the function f(n) for each node n. In the case of non-determinism, choose the nodes to expand according to the alphabetical order. Consider as heuristic h(n) the one indicated in the square next to each node in the figure. What is the produced solution and its cost?

Exercise 3

Given the following CSP:

A::[1, 2, 3, 4, 5]
B::[1, 2, 3, 4, 5]
C::[1, 2, 3, 4, 5]
D::[1, 2, 3, 4, 5]

A > B
C > B + 1
A = D - 1
B = D - 3

Find the first solution through tree search, by applying forward checking, using alphabetical order of variables and lexicographic order of values.

Exercise 4

Given the following initial state:
has_slides(ml), is_awake

Given the following actions:
study(Subject)
PRECOND: is_awake, has_slides(Subject)
DELETE: is_awake
ADD: has_knowledge(Subject)

swap_slides(Subject1, Subject2)
PRECOND: has_slides(Subject1)
DELETE: has_slides(Subject1)
ADD: has_slides(Subject2)

drink_coffee
PRECOND: ¬is_awake
DELETE: -
ADD: is_awake

We have to reach the goal:
has_knowledge(ml), has_knowledge(cv)

Solve the problem with the POP algorithm, identifying threats and their solution during the process.

Exercise 5

1) Model the action **swap_slides** (preconditions, effects and frame axioms), and the initial state of the exercise 4 using the Kowalsky formulation

2) Show two levels of graph plan when applied to exercise 4.

3) What are non-informed search strategies? Describe the strategies that have been presented during the course.

4) What is Particle Swarm Optimization and which are its main features?

5) What is modal truth criterion and why it has been defined.