Tutorial 06 Decision Tree, Hierarchical State Machine and Behavior Tree

Introduction

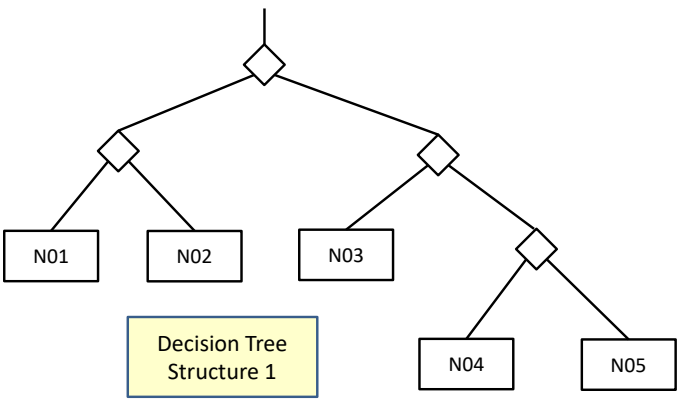
In this tutorial, you will gain better understanding about decision tree, hierarchical state machine and behavior tree. Refer to Lecture 04 handout for completing this tutorial.

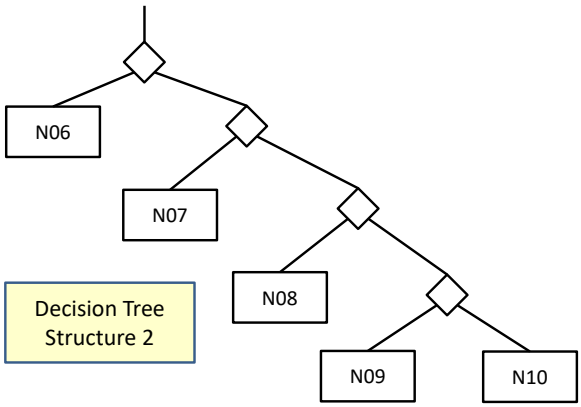
Task 1. Decision Tree

Assume that there are 5 actions A, B, C, D, E where the probability of each action is provided in the following table:

Action	Probability
A	0.5
B	0.2
C	0.1
D	0.1
E	0.1

Now you need to form the best decision tree (in terms of minimizing the average number of decisions) with these actions by considering the following 2 decision tree structures:



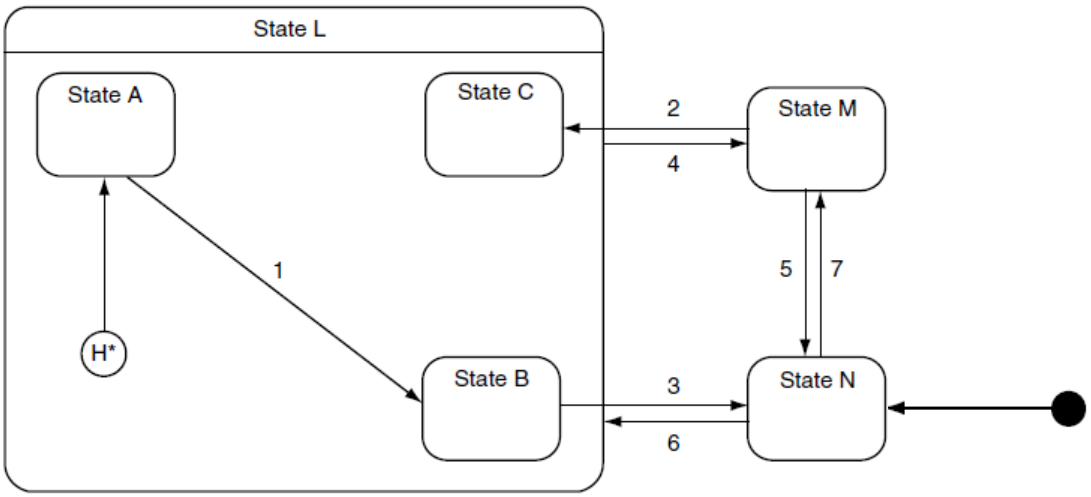


Assume that each decision takes the same amount of time and you can freely assign the actions A,B,C,D,E among the nodes N01,N02,N03,N04,N05 under decision tree structure 1 or among the nodes N06,N07,N08,N09,N10 under decision tree structure 2.

a) Which decision tree structure can give you a better decision tree?
b) Under the decision tree structure in a), how should the actions A,B,C,D,E be assigned to the leaf nodes?
c) What is the average number of decisions under the best decision tree obtained by the above decision tree structure?

Task 2. Hierarchical State Machine

A hierarchical state machine is shown in the following figure:

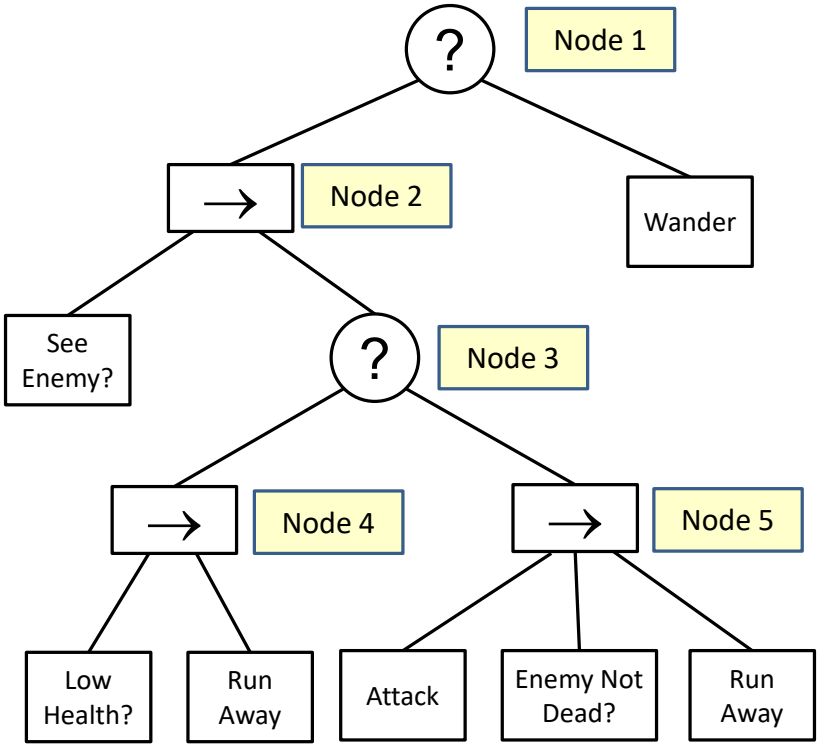


Denote L1 as the higher level that consists of states L, M, N and denote L2 as the lower level that consists of states A,B,C which are contained in state L of level L1.
Trace the above hierarchical state machine so that you can understand the possible transitions between states under L1 and L2.

a) What is the initial state when the above hierarchical state machine is first run?
b) If the current state is B, and transition 3 is triggered followed by transition 6, then it will get to state L. What will be the current state under L2?
c) If the current state is B, and transitions 4,5,6 are triggered in sequence, then it will get to state L. What will be the current state under L2?
d) If the current state is A, is it possible to get to state C through a series of transitions under L1 and/or L2?
e) If the current state is C, is it possible to get to state A through a series of transitions under L1 and/or L2?
f) If the current state is B, is it possible to get to state C through a series of transitions under L1 and/or L2?
g) If the current state is C, is it possible to get to state B through a series of transitions under L1 and/or L2?

Task 3. Behavior Tree

A behavior tree is given as follows:



Trace the above behavior tree so that you can understand the possible action(s) that will be carried out. Note that each action may be successful or failed, so different status code (success or failure) may be returned.

a) When the character with low health sees an enemy, what will be the action(s)?
b) Under what conditions will the character attack?
c) Is it possible for the character to carry out the following 2 actions, one after the other, in each of the following cases?
   i. Run away and then attack?
   ii. Attack and then run away?
   iii. Attack and then wander?
d) Will the selector node at Node 3 return true or false after the character attacks and kills an enemy?

Task 4. Complete the Canvas Quiz

Complete the quiz "Tutorial 06" on the Canvas course page (Assignments > Tutorial 06) before the end of the tutorial.
