Multiple Choice Questions - write the letter of your choice on your answer paper

1. An advantage of Iterative Deepening Minimax algorithms over Depth Limited Minimax algorithms is: [2]
   (a) you always have the solution of the previous iteration available during the execution of the current iteration [1]
   (b) information gleaned during the current iteration can be employed to increase pruning in successive iterations [1]
   (c) this removes the need to a priori decide on a fixed depth limit [1]
   (d) answers a and b [1 1/2]
   (e) answers a, b, and c
   (f) none of the above [0]

2. The best way to deal with the “horizon effect” is to: [2]
   (a) employ quiescense search [1 1/2]
   (b) employ move ordering [0]
   (c) employ singular extensions [1]
   (d) answers a and b [1 1/2]
   (e) answers a and c
   (f) answers b and c [1 1/2]
   (g) none of the above [0]

Regular Questions

The remaining questions are about the following adversarial search tree. State evaluation heuristic values for the max player are provided in the form of numbers following the letter labels of the states (e.g., A19 indicates that the state evaluation heuristic value of state A for the max player is 19). The order in which successors are generated is from left to right. Example: A generates first B, then C, and finally D.
3. Give the execution trace for HTABIDM(A,3,−∞,∞) [HTABIDM = History-Table Iterative-Deepening Depth-Limited Minimax with Alpha-Beta Pruning]. [30]

#define DLM( ) HTABDLM( ), #define Max( ) HTABMaxV( ), #define Min( ) HTABMinV( )

call frontier eval value | α, β | best action, value
-----------------------|-------|---------------------
DLM(A,1,−∞,∞) | B0C0D0 | B | MinV(B,0,−∞,∞)=1 | 1, ∞ | AB, 1
| C0D0 | C | MinV(C,0,1,∞)=5 | 5, ∞ | AC, 5
| D0 | D | MinV(D,0,5,∞)=7 | 7, ∞ | AD | 7 [AD:1]
DLM(A,2,−∞,∞) | D1B0C0 | D | MinV(D,1,−∞,∞)=6 (SSS) | 6, ∞ | AD, 6 [DK:1]
| B0C0 | B | MinV(B,1,6,∞)=4 | 6, ∞ | AD, 6
| C0 | C | MinV(C,1,6,∞)=3 | 6, ∞ | AD | 6 [AD:2]
MinV(B,1,6,∞) | E0F0G0 | E | MaxV(E,0,6,∞)=8 | 6, 8 | BE, 8
| F0G0 | F | MaxV(F,0,6,8)=4 (Prune) | 6, 8 | BF, 4 [BF:1]
MinV(C,1,6,∞) | H0I0J0 | H | MaxV(H,0,6,∞)=14 | 6, 14 | CH, 14
| I0J0 | I | MaxV(I,0,6,14)=3 (Prune) | 6, 14 | CL, 3 [CL:1]
DLM(A,3,−∞,∞) | D2B0C0 | D | MinV(D,2,−∞,∞)=9 | 9, ∞ | AD, 9
| B0C0 | B | MinV(B,2,9,∞)=3 | 9, ∞ | AD, 9
| C0 | C | MinV(C,2,9,∞)=1 | 9, ∞ | AD | 9 [AD:3]
MinV(D,2,−∞,∞) | K1 | K | MaxV(K,1,−∞,∞)=9 | −∞, 9 | DK, 9 [DK:2]
| MaxV(K,1,−∞,∞) | Y0Z0 | Y | MinV(Y,0,−∞,∞)=9 | 9, ∞ | KY, 9
| Z0 | Z | MinV(Z,0,9,∞)=3 | 9, ∞ | KY, 9 [KY:1]
MinV(B,2,9,∞) | F1E0G0 | F | MaxV(F,1,9,∞)=3 (Prune) | 9, ∞ | BF, 3 [BF:2]
| MaxV(F,1,9,∞) | P0Q0 | P | MinV(P,0,9,∞)=2 | 9, ∞ | FP, 2
| Q0 | Q | MinV(Q,0,9,∞)=3 | 9, ∞ | FQ, 3 [FQ:1]
MinV(C,2,9,∞) | I1H0J0 | I | MaxV(I,1,9,∞)=1 (SSS,Prune) | 9, ∞ | CI | 1 [IV:1,CI:2]

4. Indicate for each depth iteration of HTABIDM(A,3,−∞,∞) which nodes, if any, get pruned. [8]

Depth 1: none
Depth 2: G,J

5. What is the Principal Variant (PV) found by HTABIDM(A,3,−∞,∞)? [3]

A→D,D→K,K→Y

6. Would ABIDM(A,3,−∞,∞) have found the same PV? Explain your answer! [3]

Yes, because backward pruning methods such as αβ – pruning do not effect the outcome of a search, only its efficiency, so move ordering can only increase pruning, but not affect the search outcome.

7. Would IDM(A,3) have found the same PV? Explain your answer! [2]

Yes, because backward pruning methods such as αβ – pruning do not effect the outcome of a search, only its efficiency.