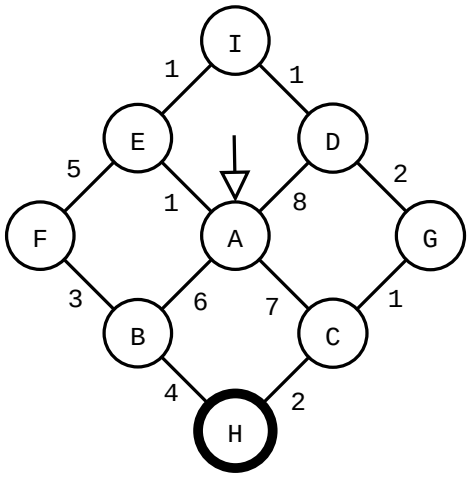
CS347 SP2005 Exam 2 Key

This is a closed-book closed-notes exam. The *only* items you are permitted to bring are writing implements. Mark every sheet of paper you use with your name and the string "cs347sp2005 exam2" (omittance, even if it is partial, will be penalized at 1 point per sheet). If you are caught cheating, you will receive a zero grade for this exam. The max number of points per question is indicated in square brackets after each question. The sum of the max points is 75. You have 75 minutes to complete this exam. Good luck!

All the questions on this page are about the following state space graph, with A being the start state and H being the goal state. The order in which successors are generated is counterclockwise, ending at exactly 9 o'clock. Example: A generates first B, then C, then D, and finally E. When sorting by path-cost, nodes with equal path-cost are ordered such that the earlier a node is generated, the higher its priority. Nodes already on the open list have higher priority than newly added nodes with equal path-cost. Heuristic $h(node)$ is defined in the following table:

node	$h(node)$
A	9
B	1
C	2
D	3
E	2
F	5
G	1
H	0
I	3



1. Give the execution trace of ID-DFGS. [8]

depth-limit=0

open	closed	eval
A	-	A

depth-limit reached and no goal found

depth-limit=1

open	closed	eval
A	-	A
BCDE	A	B
CDE	AB	C
DE	ABC	D
E	ABCD	E

depth-limit reached and no goal found

depth-limit=2

open	closed	eval
A	-	A
BCDE	A	B
HFCDE	AB	H

goal found; solution=ABH; path-cost(ABH)=10

2. Give the execution trace of UCGS. [12]

open	closed	eval
A0	-	A0
E1B6C7D8	A	E1
I2B6F6C7D8	AE	I2
D3B6F6C7	AEI	D3
G5B6F6C7	AEID	G5
B6F6C6	AEIDG	B6
F6C6H10	AEIDGB	F6
C6H10	AEIDGBF	C6
H8	AEIDGBFC	H8

goal found; solution = AEIDGCH; path-cost(AEIDGCH)=8

3. Give the execution trace of GBeFGS employing as heuristic $h(n)$. [4]

open	closed	eval
A9	-	A9
B1C2E2D3	A	B1
H0C2E2D3F5	AB	H0

goal found; solution=ABH; path-cost(ABH)=10

4. Give the execution trace of A*GS employing as heuristic $h(n)$. [12]

open	closed	eval
A9	-	A9
E3B7C9D11	A	E3
I5B7C9D11F11	AE	I5
D6B7C9F11	AEI	D6
G6B7C9F11	AEID	G6
B7C8F11	AEIDG	B7
C8H10F11	AEIDGB	C8
H8F11	AEIDGBC	H8

goal found; solution=AEIDGCH; path-cost(AEIDGCH)=8

5. Is UCGS optimal for this problem? Explain your answer! [3]

   Yes, because the branching factor is finite, the step costs are all positive, and UCGS is always optimal under those conditions.

6. Is ID-DFGS optimal for this problem? Explain your answer! [2]

   No, because it found a solution with higher path-cost than the one found by UCGS.

7. Is GBeFGS employing heuristic $h(node)$ optimal for this problem? Explain your answer! [2]

   No, because it found a solution with higher path-cost than the one found by UCGS.

8. Is $h(node)$ admissible for this problem? Explain your answer! [3]

   No, because it overestimates the remaining path-cost for some nodes; e.g., $h(A) = 9 > C^*(A) = 8$.

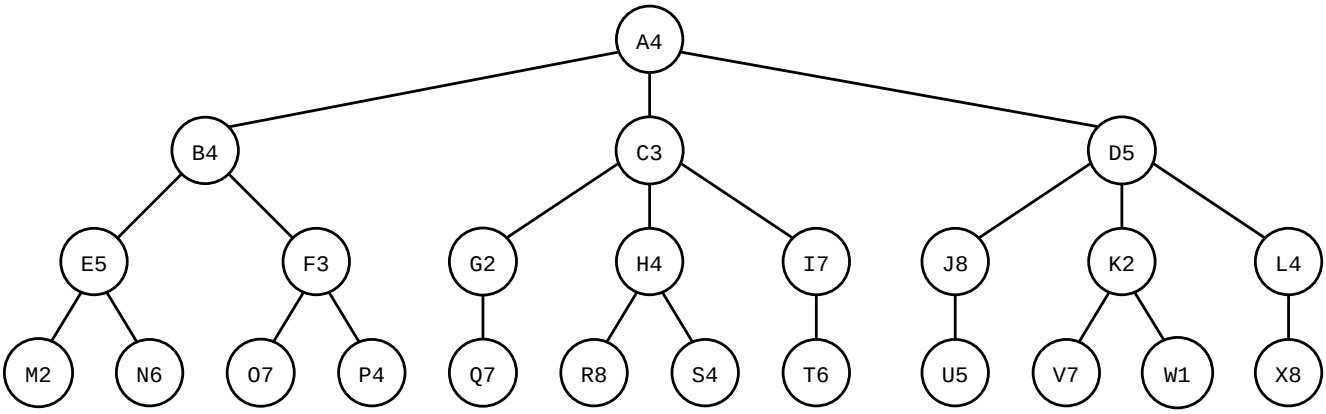
9. Is $h(node)$ consistent for this problem? Explain your answer! [2]

   No, because it is not admissible.

10. Is A*GS employing heuristic $h(node)$ optimal for this problem? Explain your answer! [2]

    Yes, because it found a solution with the same path-cost as that found by UCGS which we earlier explained is optimal for this problem.

All the questions on this page 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., A4 indicates that the heuristic value of state A for the max player is 4). The order in which successors are generated is from left to right. Example: A generates first B, then C, and finally D.



11. Give the execution trace for ABIDM(A,3,$-\infty,\infty$). [20]
#define Max( ) ABMaxV( ), #define Min( ) ABMinV( )

call	open	eval	value	α,β	best action,value
ABDLM(A,1,$-\infty,\infty$)	BCD	B	Min(B,0,$-\infty,\infty$)=4	$4,\infty$	AB,4
	CD	C	Min(C,0,4,∞)=3	$4,\infty$	AB,4
	D	D	Min(D,0,4,∞)=5	$5,\infty$	AD,5
ABDLM(A,2,$-\infty,\infty$)	BCD	B	Min(B,1,$-\infty,\infty$)=3	$3,\infty$	AB,3
	CD	C	Min(C,1,3,∞)=2	$3,\infty$	AB,3
	D	D	Min(D,1,3,∞)=2	$3,\infty$	AB,3
Min(B,1,$-\infty,\infty$)	EF	E	Max(E,0,$-\infty,\infty$)=5	$-\infty,5$	BE,5
	F	F	Max(F,0,$-\infty$,5)=3	$-\infty,3$	BF,3
Min(C,1,3,∞)	GHI	G	Max(G,0,3,∞)=2 (prune)	$3,\infty$	CG,2
Min(D,1,3,∞)	JKL	J	Max(J,0,3,∞)=8	3,8	DJ,8
	KL	K	Max(K,0,3,8)=2 (prune)	3,8	DK,2
ABDLM(A,3,$-\infty,\infty$)	BCD	B	Min(B,2,$-\infty,\infty$)=6	$6,\infty$	AB,6
	CD	C	Min(C,2,6,∞)=6	$6,\infty$	AB,6
	D	D	Min(D,2,6,∞)=5	$6,\infty$	AB,6
Min(B,2,$-\infty,\infty$)	EF	E	Max(E,1,$-\infty,\infty$)=6	$-\infty,6$	BE,6
	F	F	Max(F,1,$-\infty$,6)=7	$-\infty,6$	BE,6
Max(E,1,$-\infty,\infty$)	MN	M	Min(M,0,$-\infty,\infty$)=2	$2,\infty$	EM,2
	N	N	Min(N,0,2,∞)=6	$6,\infty$	EN,6
Max(F,1,$-\infty$,6)	OP	O	Min(O,0,$-\infty$,6)=7 (prune)	$-\infty,6$	FO,7
Min(C,2,6,∞)	GHI	G	Max(G,1,6,∞)=7 (SSS)	6,7	CG,7
	HI	H	Max(H,1,6,7)=8	6,7	CG,7
	I	I	Max(I,1,6,7)=6 (SSS,prune)	6,7	CI,6
Max(H,1,6,7)	RS	R	Min(R,0,6,7)=8 (prune)	6,7	HR,8
Min(D,2,6,∞)	JKL	J	Max(J,1,6,∞)=5 (SSS,prune)	$6,\infty$	DJ,5

12. Which nodes, if any, would get pruned by ABDLM(A,3,$-\infty,\infty$) (not ABIDM!)? [3]
P,S,K,V,W,L,X

13. Give the Principal Variant (PV) which would be found by ABDLM(A,3,$-\infty,\infty$) (not ABIDM!). [2]
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