CS-271P, Intro to A.I. — Quiz#4 — Winter Quarter, 2018 — 20 minutes

YOUR NAME AND EMAIL ADDRESS: _____

YOUR ID: _____ ID TO RIGHT: _____ ROW: _____ SEAT: _____

1. (35 pts total, 5 pts each) The Knowledge Engineering process. Your book identifies seven sequential steps in the knowledge engineering process, which are given below. Unfortunately, the order of the steps has been scrambled. Please, straighten them out.

<div style="border:1px solid red; color:red">**See Section 8.4**</div>

C.   Identify the task
G.   Assemble the relevant knowledge
E.   Decide on a vocabulary of predicates, functions, and constants
D.   Encode general knowledge about the domain
B.   Encode a description of the specific problem instance
A.   Pose queries to the inference procedure and get answers
F.   Debug the knowledge base

Fill in the blanks with the letters A, B, C, D, E, F, and G, all in the proper sequence.

   C   G   E   D   B   A   F   .

2. (30 pts total, 5 pts each) Logic-To-English. For each of the following FOPC sentences on the left, write the letter corresponding to the best English sentence on the right. Use these intended interpretations: (1) "Butterfly(x)" is intended to mean "x is a butterfly." (2) "Flower(x)" is intended to mean "x is a flower." (3) "FeedsOn(x, y)" is intended to mean "x feeds on y."

D	∀b ∃f Butterfly(b) ⇒ [Flower(f) ∧ FeedsOn(b, f)]	A	Every butterfly feeds on every	**See Section 8.2.6**
F	∃f ∀b Flower(f) ∧ [Butterfly(b) ⇒ FeedsOn(b, f)]	B	For every flower, there is som butterfly who feeds on that flo	**Note that ⇒ is the natural connective to use with ∀.**
B	∀f ∃b Flower(f) ⇒ [Butterfly(b) ∧ FeedsOn(b, f)]	C	There is some butterfly who feeds on some flower.	
E	∃b ∀f Butterfly(b) ∧ [Flower(f) ⇒ FeedsOn(b, f)]	D	For every butterfly, there is so flower that the butterfly feeds	
A	∀b ∀f [Butterfly(b) ∧ Flower(f)] ⇒ FeedsOn(b, f)	E	There is some butterfly who feeds on every flower.	**Note that ∧ is the natural connective to use with ∃.**
C	∃b ∃f Butterfly(b) ∧ Flower(f) ∧ FeedsOn(b, f)	F	There is some flower that every butterfly feeds on.	

**** TURN PAGE OVER. QUIZ CONTINUES ON THE REVERSE. ****

5. (35 points total, 7 pts each) Constraint Satisfaction Problems.
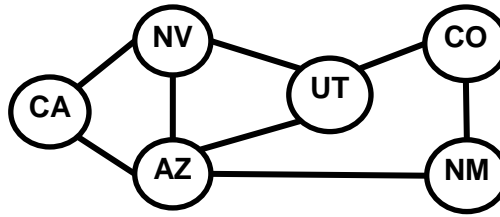
You are a map-coloring robot assigned to color this Southwest USA map. Adjacent regions must be colored a different color (R=Red, B=Blue, G=Green). The constraint graph is shown.

5.a. (7 pts total, -3 each wrong answer, but not negative) FORWARD CHECKING. Cross out all values that would be eliminated by Forward Checking, after variable AZ has just been assigned value R as shown:

CA	NV	AZ	UT	CO	NM
X̶ G B	X̶ G B	R	X̶ G B	R G B	X̶ G B

5.b. (7 pts total, -3 each wrong answer, but not negative) ARC CONSISTENCY.
CA and AZ have been assigned values, but no constraint propagation has been done. Cross out all values that would be eliminated by Arc Consistency (AC-3 in your book).

CA	NV	AZ	UT	CO	NM
B	X̶ G X̶	R	X̶ X̶ B	R G X̶	X̶ G B

5.c. (7 pts total, -3 each wrong answer, but not negative) MINIMUM-REMAINING-VALUES HEURISTIC. Consider the assignment below. NV is assigned and constraint propagation has been done. List all unassigned variables that might be selected by the Minimum-Remaining-Values (MRV) Heuristic:_____**CA, AZ, UT**_____.

CA	NV	AZ	UT	CO	NM
R B	G	R B	R B	R G B	R G B

5.d. (7 pts total, -3 each wrong answer, but not negative) DEGREE HEURISTIC. Consider the assignment below. (It is the same assignment as in problem 5c above.) NV is assigned and constraint propagation has been done. List all unassigned variables that might be selected by the Degree Heuristic:_____**AZ**_____.

CA	NV	AZ	UT	CO	NM
R B	G	R B	R B	R G B	R G B

5.e. (7 pts total) MIN-CONFLICTS HEURISTIC. Consider the complete but inconsistent assignment below. AZ has just been selected to be assigned a new value during local search for a complete and consistent assignment. What new value would be chosen below for AZ by the Min-Conflicts Heuristic?_____**R**_____.

CA	NV	AZ	UT	CO	NM
B	G	?	G	G	B