ASSIGNMENT 5:
Assigned: 4/16/18 Due: Sunday 4/22/18 at 11:55 PM Submit on moodle (in a zip if you have multiple files)

Written/drawn:
Problem 1. (20 points)
Convert the following sentence to conjunctive normal form (CNF).

$$\forall x \ (\forall y \ A(x) \wedge B(y) \iff C(x,y)) \Rightarrow (\exists y \ D(y) \wedge E(x,y))$$

Problem 2. (20 points)
Apply resolution on the following KB to determine if: $KB \models \alpha$
You must show what variables you are unifying/substituting to make resolution possible between parts/clauses.

KB:
$(A(cat) \vee C(x,y))$
$\wedge \ (\neg B(x,y) \vee C(x,y))$
$\wedge \ (\neg A(x) \vee B(hippo,x))$

$\neg \alpha$: (Note: this is already negated)
$(\forall x \ \neg B(hippo,x) \vee B(x,F(x)))$
$\wedge (\forall y \ \neg C(cat,y))$

Problem 3. (20 points)
Use backward chaining on the following sentences to determine whether: Exists x Traps(Felicidad,x)

$\exists x \ Troll(x)$
$\forall x \ Troll(x) \Rightarrow Large(x)$
$\exists x \ Troll(x) \wedge Aggressive(x)$
$\forall x \ Large(x) \wedge Aggressive(x) \Rightarrow Dangerous(x)$
$\forall x, y \ Hunter(x) \wedge Dangerous(y) \wedge Bounty(y) \Rightarrow Traps(x,y)$
$Hunter(Felicidad)$
$\exists x \ Troll(x) \wedge Bounty(x)$

Problem 4. (10 points)
Use forward-search to solve the following planning problem. Use a breadth-first-search to approach for searching the space until a goal is found. Show all possible states at the depth the goal was found as well.

$\text{Initial} = \neg Study \wedge \neg Passed$
$\text{Goal} = Study \wedge Passed$

$\quad \text{Action} = Cram,$
Precondition:
Effect: Study

$\quad \text{Action} = PassTest,$
Precondition: $Study$
Effect: $\neg Study \wedge Passed$

Problem 5. (30 points)
Apply graph-plan to the following problem until the mutexes converge (i.e. the mutexes stop changing between levels). Note: there was initially an error in action "W" that is fixed now.
$\quad \text{Initial: } A \wedge \neg B \wedge \neg C$

Action(W,
Preconditions: A
Effects: $\neg B \wedge C$)

Action(X,
Preconditions: C
Effects: $\neg C$)

Action(Y,
Preconditions: $A \wedge C$
Effects: $\neg A \wedge B$)

Action(Z,
Preconditions: $B \wedge \neg C$
Effects: $\neg B \wedge C$)