1- (6 marks) Games and puzzles are often used to describe search problems because they are easy to describe. One such puzzle is the farmer-fox-goose-grain puzzle. In this puzzle, a farmer wishes to cross a river taking his fox, goose, and grain with him. He can use a boat which will accommodate only the farmer and one possession. If the fox is left alone with the goose, the goose will be eaten. If the goose is left alone with the grain, the grain will be eaten. Draw the first three levels of a state space search tree for this puzzle.

2- (6 marks) Trace the constraint satisfaction procedure solving the following crypt arithmetic problem using depth first search:

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A B
+ C D
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D B E
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3. Given the following problem:
"If an engine turns over and it does not start then the distributor cap is bad or there is no petrol in the tank or the carburetor is blocked. My engine turns over. My engine does not start. There is petrol in my tank.

a) (4 marks) Translate these sentences into predicate logic

b) (4 marks) Put the logical expressions derived above into clause form

c) (3 marks) Show that 'My cap distributor is bad or my carburetor is blocked' follows as a logical consequence of this set of sentences using resolution by refutation method.
4. a) (4 marks) Write down logical representations for the following sentences into clause form

- An offspring of a horse is a horse.
- Bluebeard is a horse.
- Bluebeard is Charlie’s parent.
- Offspring and parent are inverse relations.

b) (2 marks) Use resolution to answer the question What are names of the Horses? (Hint you can use the query Horse(h)? and find out the unifier of h)

c) (1 mark) How many solutions for h actually follow from your sentences?