Solve this assignment

Due Date: 3/1/2022

Send the solution to Eng Heba (softcopy)

Please Answer All Questions;

Question 1

Provide brief, precise definitions of the following:

Data Pyramid and Computer-Based Systems, Cycle of Knowledge, Basic Structure of Knowledge-Based Systems, Typical Inference Cycle, Techniques of Knowledge Acquisition,

a) **Differentiate between the following terms:** Modus Ponens & Modus Tollens.
b) Why is the concept of knowledge different from the concepts of data and information?
c) What is the role of knowledge in decision making?
d) Can you identify the components of knowledge that are present within knowledge representation systems?
e) List the activities of a knowledge engineer during KBS development.
f) There are five distinct phases when transforming human knowledge into some form of KBS. The knowledge engineer plays a prominent role in these phases. What are these five phases and what duties do they contain?
g) Explain the purpose of the following elements of a knowledge-based system:
    a. Expert
    b. Repository
    c. Acquisition module
    d. Knowledge base
    e. Inference engine
    f. User

Evaluate the basic advantages and disadvantages of interviews as a method of knowledge acquisition.

Question 2

a) Suppose the database initially includes facts *A, B, C, D and E, and the* knowledge base contains only three rules:

Y ^ D → Z
X ^ B ^ E → Y
A → X

Use Forward Chaining and Backward Chaining to find or proof the goal Z.

b) Which of the following are semantically and syntactically correct translations of "No dog bites a child of its owner" ?

a. $\forall x\ Dog(x) \rightarrow \sim Bites(x, Child(Owner(x)))$

b. $\sim \exists_{x,y}\ Dog(x) \wedge Child(y, Owner(x)) \wedge Bites(x,y)$

c. $\forall x\ Dog(x) \rightarrow (\forall y\ Child(y, Owner(x)) \rightarrow \sim Bites(x,y))$

d. $\sim \exists x\ Dog(x) \rightarrow (\exists y\ Child(y, Owner(x)) \wedge Bites(x,y))$

c) Horn clauses: $Ancestor(Mother(x), x)$

$$Ancestor(x, y) \wedge Ancestor(y, z) \rightarrow Ancestor(x, z)$$

For each of the following queries, say whether the algorithm will (1) give an answer (if so, write down that answer); or (2) terminate with no answer; or (3) never terminate.

i. $Ancestor(Mother(y), John)$

ii. $Ancestor(Mother(Mother(y)), John)$

iii. $Ancestor(Mother(John), Mother(Mother(John)))$

d) Give one predicate representation for each of the following English sentences.

i. There are no green Martians.

ii. Everything painted by Picasso is valuable.

iii. Not all people have a cell phone.

Question 3

a) Dana has been murdered. Alfonso, Bonnie, and Clyde are suspects. Only one is guilty and the other two are innocent. The innocent ones told the truth to the police, but the guilty one may have lied.

Alfonso said that Bonnie and Dana were friends and that Clyde did not like Dana. Bonnie said that she was not in town at the time of the murder, and moreover, she did not know Dana. Clyde said that he saw both Alfonso and Bonnie with Dana just before the crime was committed.

Your job is to prove that Bonnie is the murderer (i.e., murderer (B)). You should do this via a proof by contradiction. I.e., assume ¬ murderer (B) and show that this leads to a something of the form P ∧ ¬P, which is a contradiction since P cannot not be both true and false.

First convert all the wff's below of the form P → Q into the logically equivalent form ¬P ∨ Q; this will make it easier to use the inference rules involving resolution. Use the inference rules

If Alfonso is innocent, Bonnie and Dana were friends and Clyde did not like Dana.

1a. innocent(A) → friends(B, D)

1b. innocent (A) → ¬likes(C, D)

If Bonnie is innocent, she was not in town, and she did not know Dana.

2a. innocent (B) → ¬inTown(B)

2b. innocent (B) → ¬knows(B, D)
If Clyde is innocent, Alfonso and Bonnie were both with Dana just before Dana was murdered.
3a. innocent (C) → with(A, D)
3b. innocent (C) → with(B, D)
Everyone who was with Dana was in town. (Some slightly contrived background knowledge.)
4. ∀ x with(x,D) → inTown(x)
Everyone knows his/her friends. (Some common-sense, background knowledge.)
5. ∀ x . ∀ y friends (x, y) → knows(x, y)
Everyone knows the people he/she likes. (Some common-sense, background knowledge.)
6. ∀ x ∀ y likes(x, y) → knows(x, y)
Among Alfonso, Bonnie, and Clyde, two are innocent.
7a. innocent (A) ∨ innocent (B)
7b. innocent (A) ∨ innocent (C)
7c. innocent (B) ∨ innocent (C)
If someone is not innocent, then he/she is the murderer.

1. ∀x ¬innocent (x) → murderer(x)