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AI Assignment - I

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1. E : universe will exist

H : ends in a heat depth

B : big bang occurs

A : universe is accelerating

X : universe is expanding

a) logical connectives :

i) $(E \vee H)$: The universe either will simply exist or end in a heat depth.

ii) $(\neg B \rightarrow E)$: If there was no big bang, the universe simply existed.

iii) $(B \Leftrightarrow X)$: If and only if the universe is expanding, there was a big bang.

iv) $((A \wedge X) \rightarrow H)$: If the universe is expanding and accelerated, then it will end in a heat depth.

b) Contrapositive :

end in a heat depth

i) $(\neg E \rightarrow H) \equiv (\neg H \rightarrow E)$: If the universe does not simply exist, it will end in a heat depth. ~~simply exist~~.

ii) ~~$(\neg B \rightarrow E)$~~ : ~~If there was no big bang, then the universe simply existed.~~

iii) ~~$(\neg X \rightarrow H) \equiv (\neg H \rightarrow \neg X)$~~ : If and only if the universe is not expanding, there was no big bang.

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ii) $\sim E \rightarrow B$: If the universe does not simply exist, then there was a big bang.

iii) $\sim H \rightarrow (\sim (A \wedge X)) \Rightarrow \sim H \rightarrow (\sim A \vee \sim X)$: If the universe does not end in a heat death, then it is either accelerating or expanding.

c) Infersed statement :

Given : $E \vee H$

$\sim B \rightarrow E$

$B \Leftrightarrow X$

$(A \wedge X) \rightarrow H$

It can be inferred that universe will either simply exist or end in a heat death. There won't be a case when "Universe will not exist and not end in a heat death."

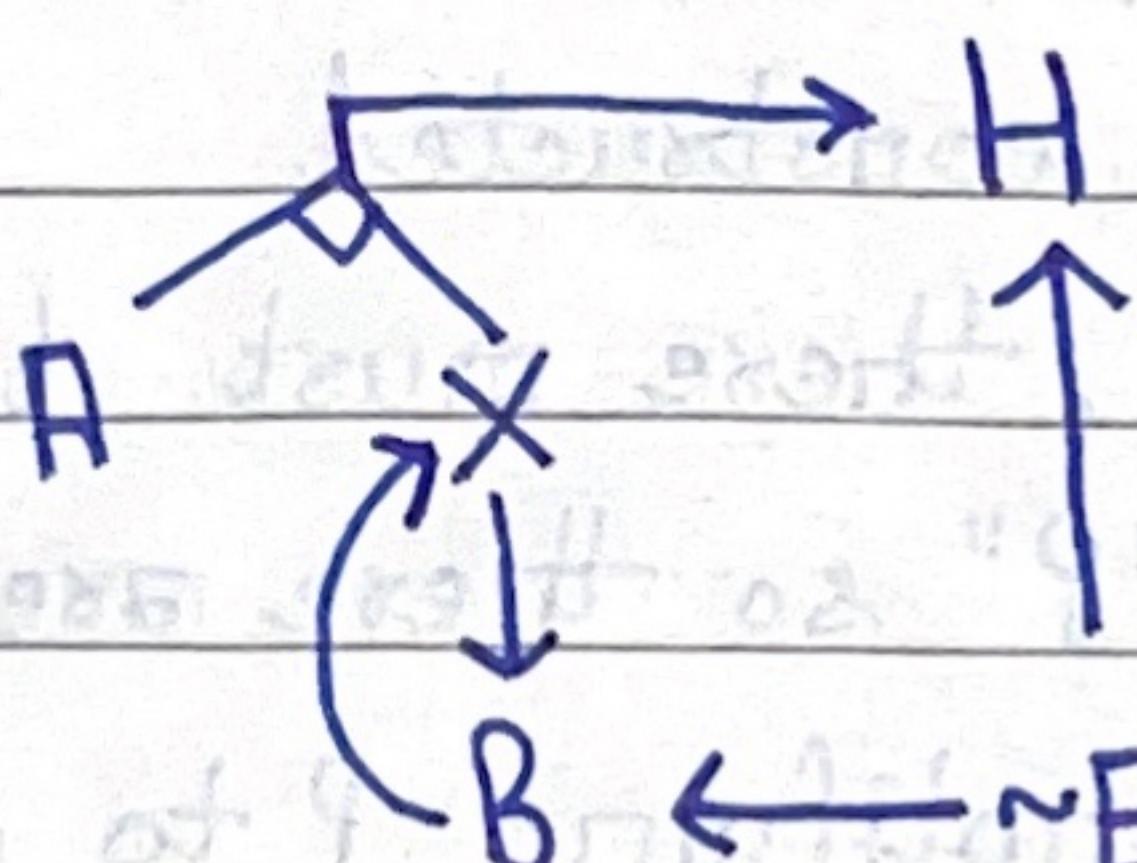
Not Infersed statement :

The provided information do not give any knowledge about shape of the universe : "Universe is spherical." or whether big bang happened : "Big bang took place."

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d) And-OR graph :

- $\sim E \rightarrow H$
- $\sim E \rightarrow B$
- $\sim X \leftrightarrow \sim B = B \leftrightarrow X$
- ~~$\sim E \rightarrow \sim H \rightarrow (\sim A \vee \sim X) = (A \wedge X) \rightarrow H$~~



3. Soundness of Resolution :

The soundness of resolution rule can be seen easily by considering literal l_i ; that is complementary to literal m_j in the other clause.

If l_i is true, then m_j is false and hence,

$m_1 \vee m_2 \dots \vee m_{j-1} \vee m_{j+1} \vee \dots \vee m_n$ must be true because $m_1 \vee \dots \vee m_n$ is given.

If l_i is false, then $\neg l_1 \vee \dots \vee \neg l_{i-1} \vee \neg l_{i+1} \vee \dots \vee \neg l_k$ must be true because $\neg l_1 \vee \dots \vee \neg l_k$ is given.

Now, l_i is either true or false, so one of these ~~conditions~~ conclusions holds — exactly as the resolution states.

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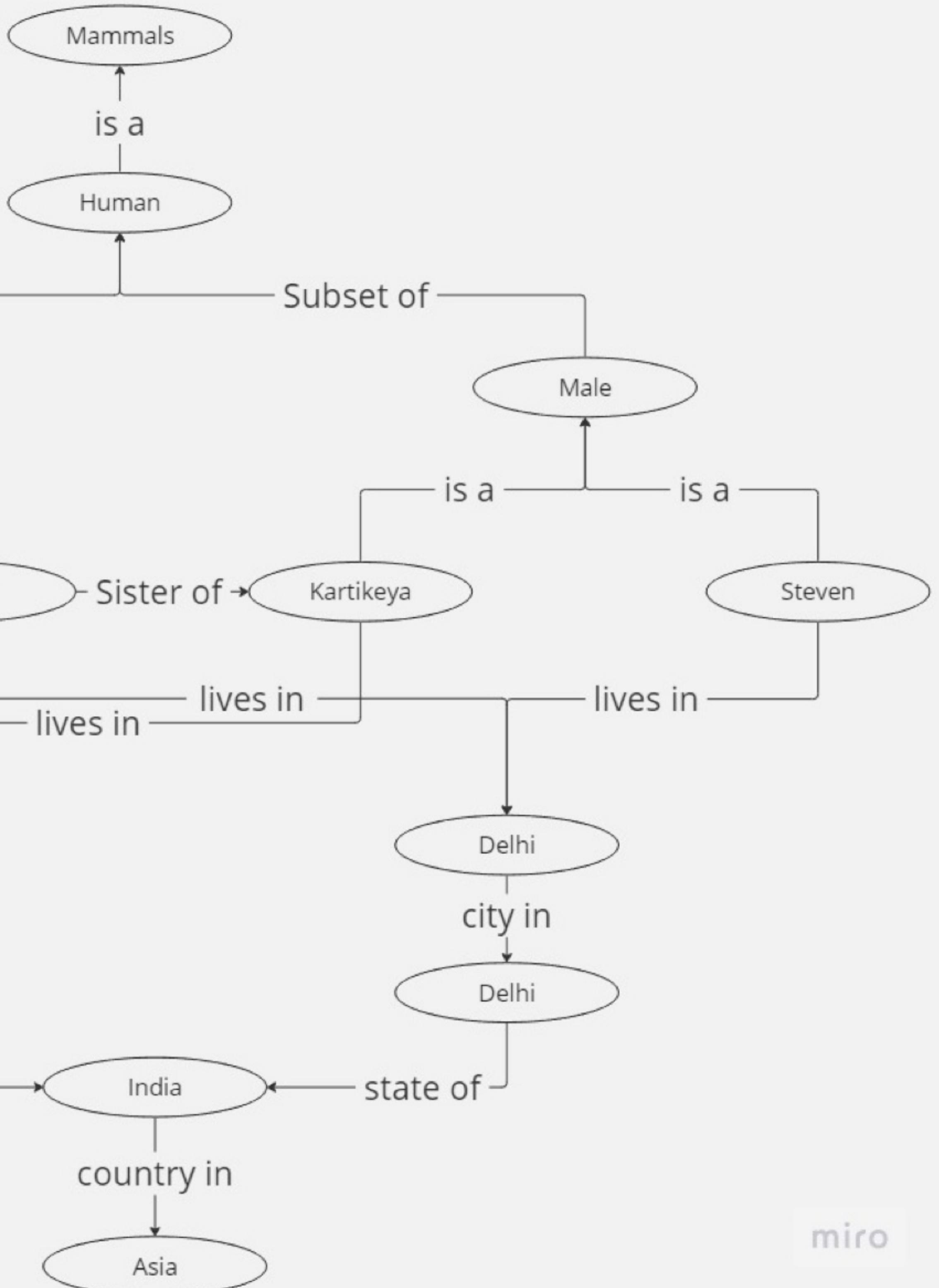
Completeness of resolution :

Let's consider a situation where we have a set of premises " P_1, P_2, \dots, P_n " referred as P . Now, there is a clause, " Q " which, in theory, can be inferred from these premises using the resolution principle, but we're unable to derive it.

According to the resolution principle, if we can derive " Q " from " P ", then it implies that " Q " can be constructed using the elements present in " P ". To do this, there must be pairs of complementary elements within " P " so there are no contradictions preventing us from simplifying P to Q .

However, our initial assumption was that " Q " cannot be achieved from the process of resolution from " P ", implying absence of such pairs of complementary elements within " P ". If Q can be represented using elements in " P ", there should be a sequence of simplification leading to " Q ".

This contradiction our assumption that system is incomplete because we know if Q can be expressed in terms of elements of P , it should be derivable through resolution.



Inheritance:

1. Shalini and Swati belong to the Female class.
2. Kartikeya and Steven belong to the Human class.

All four are examples of inheritance, where each entity will inherit all the properties of its superclass, Female and Human, respectively.

Multiple Inheritance:

1. The classes Shalini, Swati, Kartikeya, and Steven all inherit from the classes Human and Mammals.

This means that all four classes inherit the properties and behaviors of both the Human and Mammals classes, demonstrating the concept of multiple inheritance.