Q1) FOPL

(a) alkali (Sodium)

(b) $\exists y \text{ alkali}(y) \wedge (\forall x \text{ nonmetal}(x) \wedge \neg \text{noble}(x)) \rightarrow \text{react}(x, y)$

(c) $\forall y (\text{nonmetal}(y) \wedge \text{noble}(y)) \rightarrow \neg \exists x (\text{alkali}(x) \wedge \text{react}(x, y))$

(d) nonmetal(xenon) $\wedge$ noble(xenon)

(2) CNF

(a) alkali (sodium)

(b) $\forall y \neg \text{alkali}(y) \vee \exists x (\neg \text{nonmetal}(x) \vee \text{noble}(x)) \vee \text{react}(x, y)$

(c) $\exists y \neg \text{nonmetal}(y) \vee \neg \text{noble}(y) \vee \forall x \neg \text{alkali}(x) \vee \neg \text{react}(x, y)$

(d) nonmetal (Xenon) $\wedge$ noble (Xenon)

Resolution

(1) alkali (sodium)

(2) $\neg \text{alkali}(y_1) \vee \neg \text{nonmetal}(x_1) \vee \text{noble}(x_1) \vee \text{react}(x_1, y_1)$

(3) $\neg \text{nonmetal}(y_2) \vee \neg \text{noble}(y_2) \vee \neg \text{alkali}(x_2) \vee \neg \text{react}(x_2, y_2)$

(4a) nonmetal(Xenon) Δ

(4b) noble (Xenon)

? react (Xenon, Sodium)

(5) ¬nonmetal (Xenon) ∨ ¬ noble(Xenon) ∨ ¬alkali(~~Xe~~ Sodium)

- (? + 3) {Sodium/x2, Xenon,/y2}

(6) ¬nonmetal(Xenon) ∨ ¬noble(Xenon)

- (5 + 1)

(7) ¬nonmetal (Xenon) - (6 + 4b)

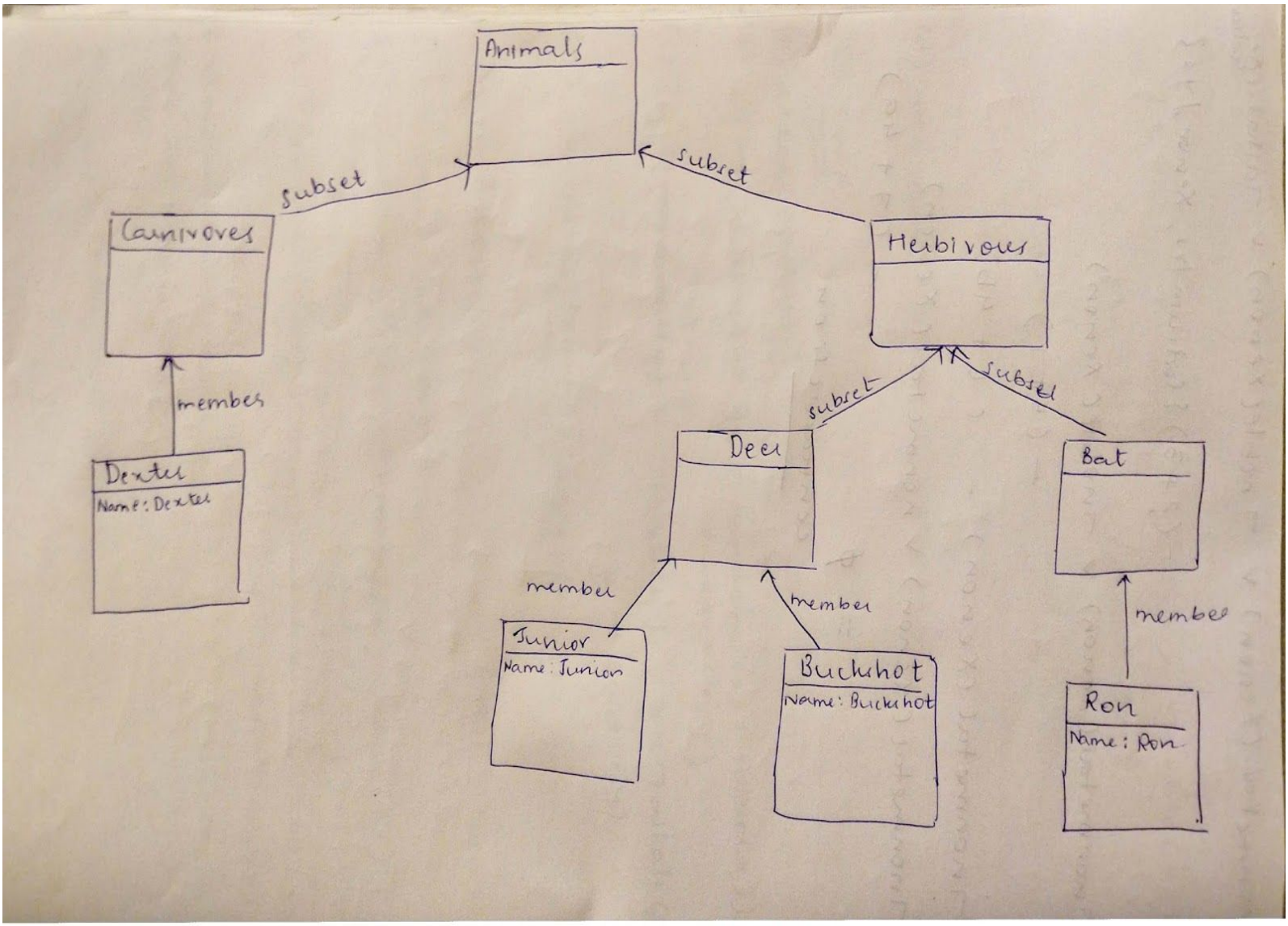
(8) ¬nonmetal (Xenon) ∨ nonmetal(Xenon)

- (7 + 4a)

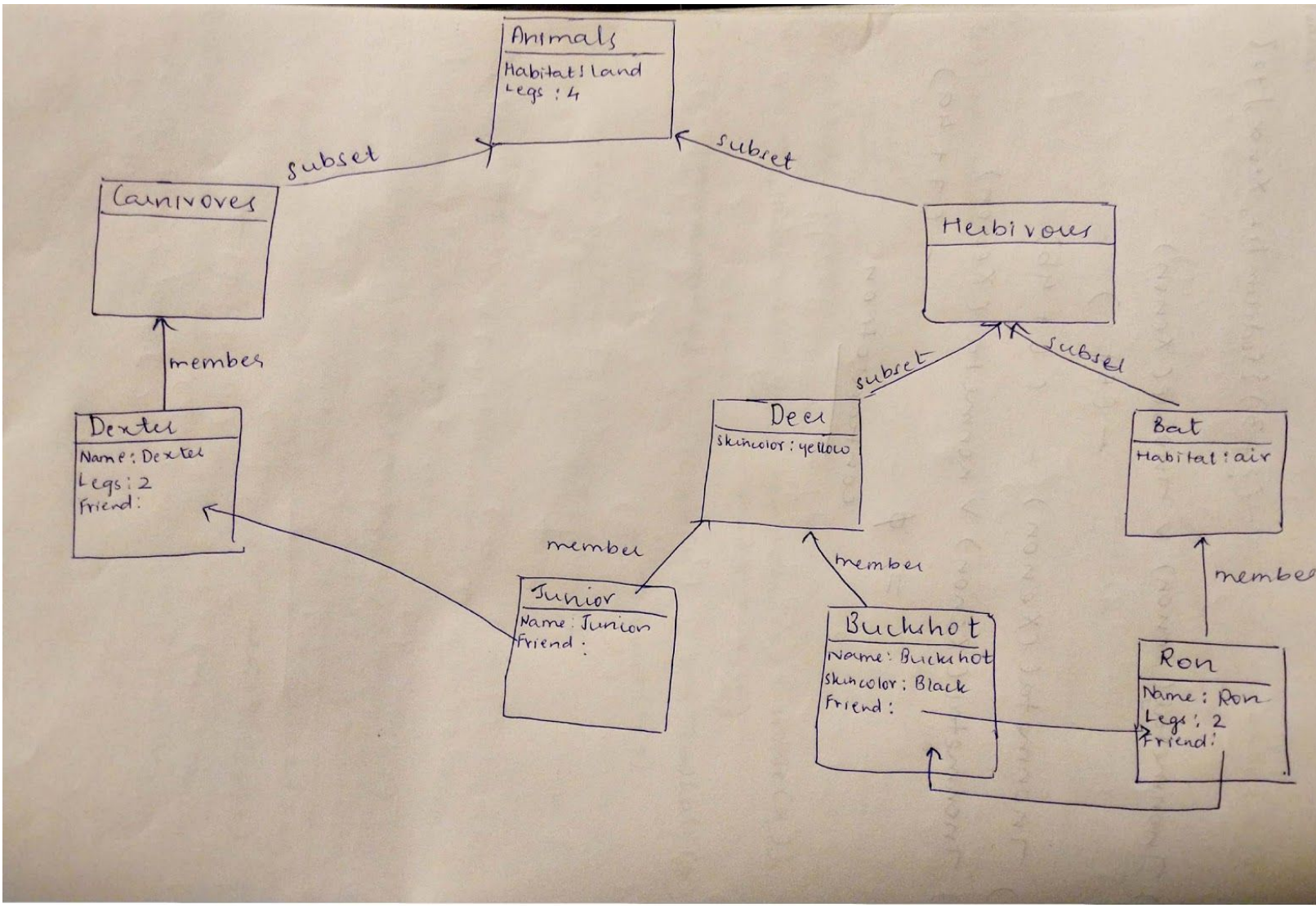
= ϕ

contradiction

Q2 - a



Q2 - b


Animals
Habitat: Land
Legs : 4
subset
subset
Carnivores
Herbivores
member
subset
subset
Dexter
Name: Dexter
Legs: 2
Friend:
Deer
skincolor: yellow
Bat
Habitat: air
member
member
member
Junior
Name: Junior
Friend:
Buckshot
Name: Buckshot
skincolor: Black
Friend:
Ron
Name: Ron
Legs: 2
Friend:

Q3)

Q3)

a)

i) client (Tom)

ii) $\exists x \; client(x) \wedge \neg(\exists y \; password(y)) \rightarrow access(x, y)$

iii) $\exists y \; password(y) \rightarrow \neg[\exists x \; client(x) \wedge access(x, y)]$

iv) password (MongoDB)

(b) Convert to CNF

(1) client (Tom)

(2) $\forall x_1 \neg client(x_1) \vee \forall y_1 \neg password(y_1) \vee access(x_1, y_1)$

(3) $\forall y_2 \neg password(y_2) \vee \forall x_2 \neg client(x_2) \vee \neg access(x_2, y_2)$

(4) password (MongoDB)

↓ CNF (skolemize)

(1) client (Tom)

(2) $\neg client(x_1) \vee \neg password(y_1) \vee access(x_1, y_1)$

(3) $\neg password(y_2) \vee \neg client(x_2) \vee \neg access(x_2, y_2)$

(4) password (MongoDB)

Resolution

? access (Tom, MongoDB)

(5) ¬client(Tom) ∨ password(MongoDB) ∨ access(Tom, MongoDB)

- (? + 2) {Tom/x1, MongoDB_y1}

(6) ¬client(Tom) - (5 + 3) {Tom/x2, MongoDB, y2}

(7) ¬client(Tom) ∨ client(Tom) {6 + 1}

= ϕ

contradiction