1.

a) Some dogs have been in a movie.

First,

Let the domain consist of all dogs.

P(x) : "x has been in a movie".

**∃xP(x)**

Second,

Let the domain consist of all living creatures.

Q(x) : "x has been in a movie".

D(x) : "x is a dog".

**∃x(Q(x) ∧ D(x))**

b) All dogs have fur.

First,

Let the domain consist of all dogs.

P(x) : "x has fur".

**∀xP(x)**

Second,

Let the domain consist of all living creatures.

Q(x) : "x has fur".

D(x) : "x is a dog".

**∀x(D(x) → Q(x))**

c) No dog can fly.

First,

Let the domain consist of all dogs.

P(x) : "x can fly".

**∀x¬P(x)**

Second,

Let the domain consist of all living creatures.

Q(x) : "x can fly".

D(x) : "x is a dog".

**∀x¬(D(x) ∧ Q(x))**

2.

a) Every Ashesi student is hardworking.

S(x) : "x is an Ashesi student"

H(x) : "x is hardworking".

U = all people

**∀x(S(x) → H(x))**

Negation: **∃x(S(x) ∧ ¬H(x))**

Negation in English: There is an Ashesi student who is not hardworking.

b) There is a pig that knows logic programming.

P(x) : "x is a pig"

K(x) : "x knows logic programming".

U = all animals

**∃x(P(x) ∧ K(x))**

Negation: **∀x¬(P(x) ∧ K(x))**

Negation in English: There is no pig that knows logic programming.

c) No cat enjoys being on camera.

C(x) : "x is a cat"

E(x) : "x enjoys being on camera".

U = all animals

**∀x¬(C(x) ∧ E(x))**

Negation: **∃x(C(x) ∧ E(x))**

Negation in English: There is a cat that enjoys being on camera.

3.

a) ∃𝑥∃𝑦𝑃(𝑥, 𝑦) –

Some faculty member from my university has taught some student from my class.

b) ∃𝑥∀𝑦𝑃(𝑥, 𝑦) –

There is a faculty member from my university that has taught all students from my class.

c) ∀𝑥∃𝑦𝑃(𝑥, 𝑦) –

Every faculty member from my university has taught at least one student from my class.

d) ∃𝑦∀𝑥𝑃(𝑥, 𝑦) –

Some student from my class has been taught by all faculty members from my university.

e) ∀𝑦∃𝑥𝑃(𝑥, 𝑦) –

Every student from my class has been taught by some faculty member from my university.

f) ∀𝑥∀𝑦𝑃(𝑥, 𝑦) –

All faculty members from my university have taught all students from my class.