

Worksheet 4

1. Use quantifiers to express each of these statements.

(a) Someone walks and talks.

$$\exists x (\text{walks}(x) \& \text{talk}(x))$$

(b) Someone walks and someone talks.

$$\exists x \exists y (\text{walks}(x) \& \text{talks}(y))$$

$$\exists x \text{walks}(x) \wedge \exists x \text{talks}(x)$$

(c) Everyone who walk is calm.

$$\forall x (\text{walk}(x) \& \text{calm}(x))$$

$$\forall x (\text{walk}(x) \rightarrow \text{calm}(x))$$

Everyone walks and calms.

(d) Everyone who sees Mary loves Mary.

$$\forall x P(x, \text{Mary})$$

$$\forall x ((x \neq \text{Mary}) \rightarrow \text{love}(x, \text{Mary}))$$

$$\forall x (\text{see}(x, \text{Mary}) \rightarrow \text{love}(x, \text{Mary}))$$

(e) If anyone cheats, everyone suffers.

$$\forall x (\text{cheats}(x) \rightarrow \text{suffers}(y))$$

2. Given $C(x): x$ is a DBM2033 student and $L(x): x$ loves music.
Express the quantifications in English sentences.

(a) $\forall x L(x)$

Everyone ~~DBM2033 student~~ loves music. ✓

(b) $\forall x \neg L(x)$

~~Everyone DBM2033 student~~ ~~doesn't~~ loves music.
No student. ✓

(c) $\exists x L(x)$

Someone ~~DBM2033 student~~ loves music. ✓

(d) $\forall x (C(x) \rightarrow L(x))$

Everyone ~~who DBM2033 student~~ loves music. ✓

(e) $\exists x (C(x) \wedge L(x))$

Someone ~~is~~ ~~DBM2033 student~~ ~~and~~ loves music. ✓