— = Free

4.1

		Formulae	Sentence	
I)	$\forall x (P^1_1 x \to Q^1 \underline{y})$	✓	✗	✓
II)	$\exists x \neg(\neg\neg\exists y P^1_y \wedge \neg\neg\neg\neg\neg R^2 xa)$	✓	✓	✓
III)	P^0	✓	✓	✓
IV)	$\forall x \exists y \exists z (R^3_{25} xyz)$	✓	✓	No, because of the brackets
V)	$\forall x \exists x Q^2_{xx}$	According to HLM it is sentence & a formulae. According to the rule in the slides it is not.		
VI)	$\neg(\neg(\exists x P^1_x \wedge \exists y Q^1_y))$	✗	✗	✓
VII)	$\forall x(\exists y(P^2_{xy} \wedge P^1_x) \vee Q^3 x \underline{y} x)$	✓	✗	✓

Interesting, let's discuss in class. According to Halbach this is straghtforwardly a sentence

4.2

I) $(\forall x \forall y (P^2_4 xy \to (P^2_{44} yx \wedge R^2_x)))$ ∀x∀y(Pxy→(Pyx∧Rx))

II) $(\forall x R^3 xx\underline{z} \wedge \exists y R^3 \underline{x}\underline{z}x)$ ✓

III) $(\neg\forall z_2 R^2 \underline{x}\underline{z})$ No brackets, well done on the free variables

IV) $(\forall x \neg\neg((P^2 x\underline{y} \vee R^2 yx) \vee R^2 \underline{z}\underline{y}))$ ∀x¬¬((Pxy∨Ryx)∨Rzy)

4.3

I) a: London

~~B~~ P^1: ...$_1$ is big

R^1: ...$_1$ is ugly

$$P^1 a \wedge R^1 a$$

II)

c: Culham

P^1: ...$_1$ is a large village

$$P^1 c$$

III)

P^1: ...$_1$ is a city

Q^1: ...$_1$ is a city hall

R^2: ...$_1$ has ...$_2$

$$\forall x (P^1 x \to \exists y (Q^1 y \wedge R^2 x y))$$

IV)

P^1: ...$_1$ is a material object

Q^1: ...$_1$ is divisible

$$\forall x (P^1 x \to Q^1 x)$$

V) a: tom

P^1: ...$_1$ is a car

Q^2: ...$_1$ owns ...$_2$

$$\exists x (P^1 x \wedge Q^2 a x)$$

VI)

a : tom

P^1 : …₁ is a car

Q^2 : …₁ owns …₂

R^2 : …₁ ~~do~~ won't sell …₂

$$\exists x(P^1_x \wedge Q^2_{ax} \wedge R^2_{ax})$$

Yes, although you could have had R: … will sell … and then put in a negative

VII)

P^1 : …₁ is a man

Q^1 : …₁ is a country

R^2 : …₁ has visited …₂

$$\exists x(P^1_x \wedge \forall y(Q^1_y \rightarrow R^2_{xy}))$$

4.4

I) tom acts freely.

II) ~~4a~~ Either tom ~~is~~ acts freely, or ~~tom~~ it is not the case that tom is a person.

III) Every person acts freely.

IV) Someone is a person if and only if they act freely.

V) It is not the case that there exists someone who acts freely.

Yes, careful with the 'someone'. That implies person, which isn't specified yet. In both iv and v it would be better to say 'something is a person iff …' or 'nothing acts freely'

4.5

I) It is not the case that there exists a set. Yes. Alt.: 'there are no sets'

II) It is not the case that every set has at least one element

III) there exists a set with no elements.

IV) there does ~~[illegible]~~ not exist a set that contains everything.
everything as an element

7.2

I) P^1: ..., is a Book author

Q^1: ..., is famous

$\neg\forall x(P^1x \to Q^1x)$

Yes, alternatively you can include a book predicate:
$\neg\forall x(\exists y(Py \wedge Qxy) \to Rx)$ where
P: ...is a book
Q: ... is the author of ...
R: ...is famous

II) P^1: ..., is a Book

Q^1: ..., is Famous

$\exists x(P^1x \wedge Q^1x)$

III) P^1: ..., is a Book

Q^1: ..., is Famous

R^1: ..., is well written

$\forall x(P^1x \to (Q^1x \leftrightarrow R^1x))$

III) a: tom

P^1: ... 1 is a Book author

Q^1: ... 1 is Famous

R^2: ... 1 does not believe that ... 2 exists

$\forall x (P^1_x x \Rightarrow$

$\exists x (P^1 x \wedge Q^1 x$

a: tom

P^1: ... believes that not every Book author is Famous.

$\neg P^1 a$ ✓

a: tom

b: the Believe that not every Book author is Famous

P^2: ... 1 Believes ... 2

$P^2 ab$

(you could make the case that b refers to just a single thing, multiple People can have the same Belief)

7.3

I) b: Ben

P^2: ...$_1$ despises ...$_2$

Q^1: $_1$ is a logician

$\forall x(Q^1 x \to P^2 bx)$ | $\exists x(Q^1 x \wedge P^2 bx)$

II) a: Harry

b: Ron

P^2: ...$_1$ is a parent of ...$_2$

Q^2: ...$_1$ slanders ...$_2$

$$Q^2 ab \wedge \forall x(P^2 xa \to Q^2 ax)$$

or: $Q^2 ab \wedge \forall x(P^2 xb \to Q^2 ax)$

III)

P^1: $_1$ is a student

Q^1: ...$_1$ is a tutor

R^2: ...$_1$ is better than ...$_2$

$$\forall x(P^1 x \to \forall y(Q^1 y \to R^2 xy))$$

or: $\forall x(P^1 x \to \exists y(Q^1 y \wedge R^2 xy))$

or: $\exists x(P^1 x \wedge \forall y(Q^1 y \to R^2 xy))$

or: $\exists x(P^1 x \wedge \exists y(Q^1 y \wedge R^2 xy))$

Well done! Present this in class?

~~Only rich Germans~~

IV)

~~R~~ P^1: $\ldots_1$ is rich

Q^1: $\ldots_1$ is German

R^1: $\ldots_1$ is a house

P^1_1: $\ldots_1$ is in Munich

~~Q_1 ...~~ P^2: $\ldots_1$ Buys $\ldots_2$

~~One house vs. multiple houses~~

$$\forall x((R^1x \wedge P^1_1x) \to \exists y(P^1y \wedge Q^1y \wedge P^2yx))$$

Only rich Germans Buy houses in Munich

If a house is in munich, then there exists a rich German who ~~B~~ Buys it.

However, it might also ~~mean~~ Be possible that the houses get Bought By nobody. so:

If a house is in Munich, then ~~a~~ there does not exist ~~a rich~~ ~~German~~ someone who is not rich ~~and~~ German who Buys the house:

$$\forall x((R^1x \wedge P^1_1x) \to \neg\exists y(\neg(P^1y \wedge Q^1y) \wedge P^2yx))$$

You might have slightly overcomplicated this. Consider: ‘Everybody buying a house in Munich is rich and German.’ ∀x (Q x → P x ∧ R x) and ‘Every German buying a house in Munich is rich.’ ∀x(Px → (Qx →Rx)), where P: … is a German, Q: … buys a house in Munich, and R: … is rich.

V)

a: James

P^1: ...₁ is a fast car

Q^2: ...₁ likes ...₂

$\forall x (P^1 x \to Q^2 ax)$

or: $\exists x (P^1 x \land Q^2 ax)$

VI)

P^1: ...₁ is a mistake

Q^1: ...₁ is a thing that is capable of making mistakes

interesting differentiation from Halbach's 'is a person'

*

R^2: ...₁ made ...₂

$\exists x (P^1 x \land \forall y (Q^1 y \to R^2 yx))$

or: $\forall x (Q^1 x \to \exists y (P^1 y \land R^2 xy))$