KOÇ UNIVERSITY
EQUR 121
FINAL EXAM May 22, 2014
Burak Özbekçi
Duration of Exam: 90 minutes
No questions, and talking allowed.

LAST NAME: _______________________

NAME: __________________________

Student ID no: ____________________

Signature: _________________________

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Problem 1 (5x10=50pts) Translate into symbolic logic language.

(a) Someone who is lying hates anyone who always tells the truth.
\[ Lx = x \text{ is lying}, \ Tx = x \text{ always tells the truth}, \ Hxy = x \text{ hates } y. \]

(b) Riker is liked by no one, unless he defeats all Romulans.
\[ r = \text{Riker}, \ Lxy = x \text{ likes } y, \ Dxy = x \text{ defeats } y, \ Rx = x \text{ is a Romulan} \]

(c) Everything is mortal or immortal and any worshipped deity is immortal.
\[ Mx = x \text{ is mortal}, \ Dx = x \text{ is a deity}, \ Wx = x \text{ is worshipped}. \]

(d) Some students are failing every class they have, but some are not.
\[ Sx = x \text{ is a student}, \ Fxy = x \text{ fails } y, \ Cx = x \text{ is a class}, \ Hxy = x \text{ has } y. \]

(e) Dinosaurs and birds have a common ancestor.
\[ Dx = x \text{ is a dinosaur}, \ Bx = x \text{ is a bird}, \ Axy = x \text{ is an ancestor of } y. \]

(f) No one who has survived a shipwreck is not protected by Neptune.
\[ Sxy = x \text{ survives } y, \ Wx = x \text{ is a shipwreck}, \ Pxy = x \text{ is protected by } y, \ n = \text{Neptune} \]
(g) The only rich soccer players are good athletes or obnoxious snobs.

\[ Rx = x \] is rich, \[ Sx = x \] is a soccer player, \[ Ax = x \] is a good athlete, 
\[ Ox = x \] is an obnoxious snob.

(h) No cat wants any dog unless every dog has a mouse.

\[ Cx = x \] is a cat, \[ Wxy = x \] wants \( y \), \[ Dx = x \] is a dog, \[ Hxy = x \] has \( y \), 
\[ Mx = x \] is a mouse.

(i) No student who does not respect him or herself is respected by every student.

\[ Sx = x \] is a student, \[ Rxy = x \] respects \( y \).

(j) Demanding professors challenge all of their students.

\[ Dx = x \] is demanding, \[ Px = x \] is a professor, \[ Cxy = x \] challenges \( y \), 
\[ Sxy = x \] is a student of \( y \).
Problem 2 (10 pts) Problem 8 (10 pts) Fill in the blanks. One word for each blank!

(a) An ___________ is a collection of ___________ one of which is designated as the ___________, and the remainder of which are designated as the ___________.

(b) No ___________ with all true ___________ but a ___________ conclusion is valid.

(c) A ___________ $A \leftrightarrow B$ is false if its constituents have ___________ truth values; otherwise, it is ___________.
Problem 3 (10 pts) Construct a derivation of the conclusion from the premises.

(1) $\exists x (Fx \land Kxa)$  \hspace{1cm} Pr

(2) $\exists x [Fx \land \forall y (Ky a \rightarrow \sim Rx y)]$  \hspace{1cm} Pr

(3) SHOW: $\exists x [Fx \land \exists y (Fy \land \sim Ry x)]$  \hspace{1cm} DD (use direct derivation)
Problem 4 (10 pts) Construct a derivation of the conclusion from the premises.

(1) \( \exists x [F x \land \sim \exists y (G y \land R x y)] \) \hspace{1cm} Pr

(2) SHOW: \( \forall x [G x \rightarrow \exists y (F y \land \sim R y x)] \)
Problem 5 (10 pts) Construct a derivation of the conclusion from the premises.

(1) \( \exists x \exists y Rxy \) 
(2) \( \forall x \forall y (Rxy \rightarrow \forall z Rxz) \) 
(3) \( \forall x (\forall z Rxz \rightarrow \forall y Ryx) \) 
(4) SHOW: \( \forall x \forall y Rxy \)
Problem 6 (10 pts) Construct a derivation of the conclusion from the premises.

(1) $\forall x (Fx \to Kxa)$  
(2) $\exists x [Gx \land \sim \exists y (Ky a \land Rxy)]$  
(3) SHOW: $\exists x [Gx \land \sim \exists y (Fy \land Rxy)]$ ID (use indirect derivation)