Assignment #5
CIS 427/527

Group 2

February 21, 2016

2.2.1

Which of the following strings are formulas in predicate logic?

Solution

(a),(b),(f),(g) are formulas.

(c) isn't, as $f(m)$ is a term.
(d) isn't, as B is expecting two terms, yet $B(m, x)$ is a formula.
(e) isn't, as $B(m)$ doesn't have enough arguments.
(h) isn't, as $B(x)$ doesn't have enough arguments.

2.5.3

Solution

2.5.11

Solution

2.6.1

Solution

2.6.2

Consider the sentence

$$\phi = \forall x\ \exists y\ \exists z\ (P(x, y) \wedge P(z, y) \wedge (P(x, z) \rightarrow P(z, x)))$$

Which of the following models satisfies ϕ?

(a) $P^M = \{(m, n) | m < n\}$
(b) $P^{M'} = \{(m, 2 * m) | m \text{ natural number}\}$
(c) $P^{M''} = \{(m, n) | m < n + 1\}$

Solution

(a) This model does not satisfy ϕ, because we either need to force $P(x, z)$ to be false by requiring z to be smaller than x (in which case we can escape the natural numbers), or by having $x < z \wedge z < x$, which cannot happen.
(b) Yes, because the first two properties say $y = 2 * x$ and $y = 2 * z$, which means $x = z$ making $P(x, z)$ always false.
(c) Yes, let $y = z = x$, then all the properties hold.

2.6.3

Solution

2.7.5

Solution