AI homework 10

9.6

a. $Horse(x) \Rightarrow Mammal(x)$

$Cow(x) \Rightarrow Mammal(x)$

$Pig(x) \Rightarrow Mammal(x)$

b.$Offspring(x, y) \land Horse(y) \Rightarrow Horse(x)$

c.$Horse(Bluebeard)$

d.$Parent(Bluebeard, Charlie)$

e.$Offspring(x, y) \Rightarrow Parent(y, x)$

$Parent(x, y) \Rightarrow Offspring(y, x)$

f.$Mammal(x) \Rightarrow Parent(G(x), x)$

9.7

a. Let $P(x, gy)$ be the relation "a is less than g"over the integers. Then $\forall_x \ \exists_y \ P(x, y)$ is true but $\exists_x \ p(x, x)$is false.
b. Converting the premise to clausal form gives $P(x, SkO(x))$ and converting the negated goal to clausal form gives $\neg P(q, q)$. If the two formulas can be unified, then these resolve to the null clause.
c. If the premise is represented as $P(x, Sk0)$ and the negated goal has been correctly converted to the clause $\neg P(q, q)$ then these can be resolved to the null clause under the substitution $q/SkO, x/SkO$.
d. Suppose you are given the premise a Cat(x) and you wish to prove Cat(Socrates). Converting the premise to clausal form gives the clause Cat(Sk1).If this unifies with Cat(Socrates) then you can resolve this with the negated goal $\neg Cat(Socrates)$ to give the null clause.

9.9

a.

Goal G0: 7≤3+9
Resolve with (8){x1/7,z1/3+9}.
Goal G1: 7≤z1
Resolve with (4){x2/7, y1/7+0}.Succeeds.
Goal G2: 7+0<3+9.
Resolve with (8) {x3/7+0,z3/3+9}
Goal G3: 7+0≤g3
Resolve with (6){x4/7, g4/0, g3/0+7} Succeeds.

Goal G4: 0+7≤3+9

Resolve with (7){w5/0, a5/7, g5/3,z5/9}.
Goal G5: 0<3.
Resolve with (1).Succeeds.
Goal G6: 7≤9.
Resolve with (2).Succeeds.

G4 Succeeds. G2 Succeeds. G0 Succeeds.

b.

b. From (1),(2),(7){w/0, /7, y /3,z/9} infer
(9)0+7<3+9.
From (9),(6),(8){1/0, y1/7, c2/0+7, y2/7+0, z2/3+9}infer
(10)7+0≤3+9.
(a1, g1 are renamed variables in(6).a;2, j2,z2 are renamed variables in (8).)
From (4),(10),(8){ x3/7,a4/7, y4/7+0, z4/3+9} infer
(11)7<3+9.
(x3 is a renamed variable in (4).x4, g4,z4 are renamed variables in (8).)

9.23

a.

$\forall_x \ Horse(x) \Rightarrow Animal(x)$

$\forall_{x,h} \ Horse(x) \wedge HeadOf(h,x) \Rightarrow \exists_y Animal(y) \wedge HeadOf(h,y)$

b.

A. $\neg Horse(x) \vee Animal(x)$

B.$Horse(G)$

C.$HeadOf(H,G)$

D.$\neg Animal(y) \vee \neg HeadOf(H,y)$

(Here A. comes from the first sentence in a. while the others come from the second. H

and G are Skolem constants.)
c. Resolve D and C to yield $\neg Animal(G)$.Resolve this with A to give $\neg Horse(G)$.