CS161 HW5

#1

a)

f	s	s→f ①	!s→!f ②	①→②	
F	F	T	T	T	
F	T	F	T	T	Neither
T	F	T	F	F	
T	T	T	T	T	

b)

f h s	S→F ③	svH ④	④→F ⑤	③→⑤	
F F F	T	F	T	T	
F F T	F	T	F	T	
F T F	T	T	F	F	
F T T	F	T	F	T	Neither
T F F	T	F	T	T	
T F T	T	T	T	T	
T T F	T	T	T	T	
T T T	T	T	T	T	

⑥ (circled)

c)

(s∧h)	⑥→F ⑦	H→F ⑧	③v⑧ ⑨	⑦<=>⑨
F	T	T	T	T
F	T	T	T	~~F~~ T
F	T	F	T	~~F~~ T
T	~~T~~ F	F	F	T
F	T	T	T	T
F	T	T	T	T
F	T	T	T	T
T	T	T	T	T

Valid

#2

a) mythical $\Longrightarrow$ immortal   Mortal $\equiv$ ¬immortal

$\quad$ ¬mythical ⟺ (mortal ∧ mammal) (uses ⟹)

$\quad$ (immortal ∨ mammal) ⟹ horned

$\quad\quad$ horned ⟹ magical

b) (¬mythical ∨ immortal) ∧ (mythical ∨ (¬immortal ∨ mammal))

$\quad$ ∧ (¬(immortal ∨ mammal) ∨ horned) ∧ (¬horned ∨ magical)

(¬mythical ∨ immortal) ∧

(mythical ∨ ¬immortal) ∧

(mythical ∨ mammal) ∧

(¬immortal ∨ horned) ∧

(¬mammal ∨ horned) ∧

(¬horned ∨ magical)

c) iii) KB ⊨ horned   Show (KB ∧ ¬horned) unsatisfiable

(¬mythical ∨ immortal)   (¬immortal ∨ horned) (mythical ∨ mammal)

                                        (¬mammal ∨ horned)

(¬mythical ∨ horned)   (mythical ∨ horned)

         (horned)   (¬horned)

Empty Clause   □

$\quad$ ∴ KB ⊨ horned

ii) $KB \models magical$, show $(KB \wedge \neg magical)$ unsatisfiable

$(\neg immortal \vee horned)$ $(\neg horned \vee magical)$ $(\neg mammal \vee horned)$

$(\neg immortal \vee magical)$ $(magical \vee \neg mammal)$

$(\neg mythical \vee immortal)$ $(mythical \vee mammal)$

$(magical \vee \neg mythical)$ $(mythical \vee magical)$
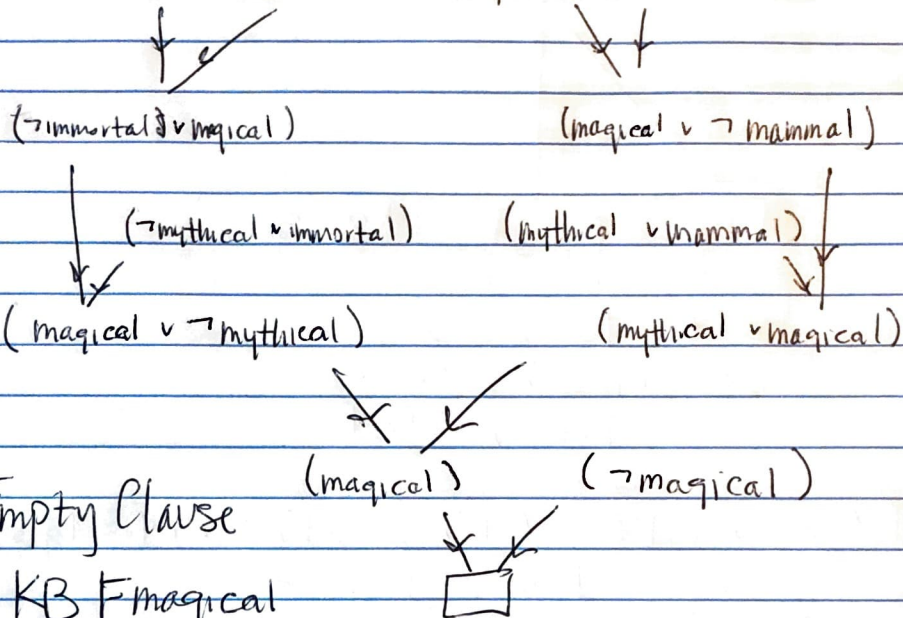
$(magical)$ $(\neg magical)$

Empty Clause

$\therefore KB \models magical$

i) Impossible to tell
Suppose not mythical.

the combination
mythical:	O	F
immortal:	O	F
mammal:	1	T
horned:	1	T
magical:	1	T

Satisfies $(KB \wedge \neg mythical)$

#3

Start

.5   .2   .3

Oil   gas   Neither
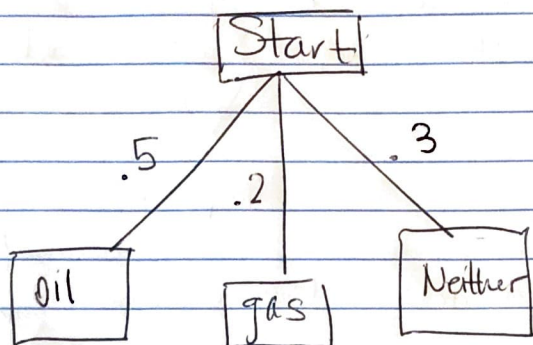
Pr (test | oil) = 0.9
P (test | gas) = 0.3
P (test | neither) = 0.1

$P(\text{test}) = P(\text{test} | \text{oil}) \cdot P(\text{oil}) + P(\text{test} | \text{gas}) \cdot P(\text{gas})$
$\quad + P(\text{test} | \text{neither}) \cdot P(\text{neither})$
$= 0.9 \cdot 0.5 + 0.3 \cdot 0.2 + 0.1 \cdot 0.3$
$= \cancel{0.83} \; 0.54$

$P(\text{oil} | \text{test}) = \dfrac{P(\text{oil}) \, P(\text{test} | \text{oil})}{\cancel{P(\text{oil} | \text{test})} \; P(\text{test})}$

$= \dfrac{0.5 \cdot 0.9}{\cancel{0.83} \; 0.54}$

$= 0.83$