## 19075478 INST0072 Logic and Knowledge Representation Dr Rob Miller Assessment 1

## Find cnf $\neg$ [( $\neg$ gamble $\land$ work) $\rightarrow$ happy]

$$\neg [(\neg gamble \land work) \rightarrow happy]$$

$$\equiv \neg [\neg (\neg gamble \land work) \lor happy] \quad implication$$

$$\equiv \neg \neg (\neg gamble \land work) \land \neg happy \quad de Morgan$$

$$\equiv \neg gamble \land work \land \neg happy \quad Cancellation$$

cnfset  $\neg$ [( $\neg$ gamble  $\land$  work)  $\rightarrow$  happy]={ $\neg$ gamble, work,  $\neg$ happy} $\triangleright$ 



## Show that KB $\models$ ( $\neg$ gamble $\land$ work) $\rightarrow$ happy

By the Resolution Soundness and Completeness theorem it is sufficient to show that:

 $KB \cup cnfset \neg [(\neg gamble \land work) \rightarrow happy] \vdash_{res} \bot$ 

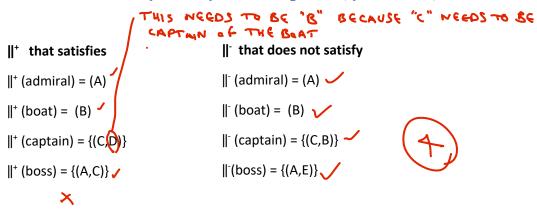
## A derivation of this is as follows:

(1) (¬rich ∨ ¬healthy ∨ happy), 🗸	by assumption from KB $\cup$ {¬[(¬gamble $\land$ work) $\rightarrow$ happy] }
(2) (stressed V healthy),	by assumption from KB $\cup$ {¬ [(¬gamble $\land$ work) $\rightarrow$ happy]}
(3) (gamble V¬stressed),	by assumption from KB $\cup$ {¬[(¬gamble $\land$ work) $\rightarrow$ happy] }
(4) (¬work V gamble V rich),	by assumption from KB $\cup$ {¬[(¬gamble $\land$ work) $\rightarrow$ happy] }
(5) (¬gamble)	by assumption from KB $\cup \{\neg[(\neg gamble \land work) \rightarrow happy]\}$
(6) (work)	by assumption from KB $\cup \{\neg[(\neg gamble \land work) \rightarrow happy]\}$
(7) (¬happy)	by assumption from KB $\cup \{\neg[(\neg gamble \land work) \rightarrow happy]\}$
(8) (healthy V gamble)	by (2), (3), resolution
(9) (healthy)	by (5), (8), resolution
(10) (¬rich Vhealthy)	by (7), (1), resolution  by (7), (1), resolution  The alm
(11) (¬stressed)	by (7), (1), resolution by (5), (3), resolution
(12) (gamble (17)rich )	by (6), (4), resolution
· (13) (-rich)	by (12), (5), resolution by (13), (4), resolution  3
· (14) (¬work (\)gamble)	by (13), (4), resolution (3)
(15) (gamble)	by (14) (6) resolution
(16) ⊥	by (14), (0), resolution  BE CAREFUL WITH "7" RD.
	by(15), (5), resolution

Using the domain of discourse  $D = \{A,B,C,D,E\}$  and signature  $\{\{\},\{\},\{admiral/1,boat/1,captain/2,boss/2\}\}$ 

Give one interpretation I + that satisfies and another interpretation I – that does not satisfy the following sentence:

 $\forall x.[admiral(x) \rightarrow \forall y.(boat(y) \rightarrow \exists z.[captain(z, y) \land boss(x, z)])]$ 

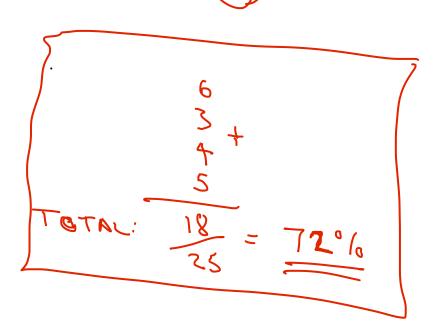


Convert the sentence  $\forall x.[admiral(x) \rightarrow \forall y.(boat(y) \rightarrow \exists z. [captain (z, y) \land boss (x, z)])]$  into prenex normal form:

$$\forall x. [\neg admiral(x) \lor \forall y (\neg boat(y) \lor \exists z. [captain(z, y) \land boss(x, z)])$$

Eliminating  $\Rightarrow$ 
 $\forall x. [\neg admiral(x) \lor \neg boat(y) \lor [captain(z, y) \land boss(x, z)])$ 

Moving Quantifiers Out



GOOD WORK ON
THE WHOLE, WITH
JUST ONE OR TWO
ERRORS - JEE ME
IF YOU NEED MORE
EXPLANATION.