

MATH 210: Who can eat both?

NAME:

1. Consider the following problem:

Aaron, Bob, and Chad all go out to eat together every day for lunch. They each order either a ham sandwich or a pork loin. However, they always adhere to the following rules:

- i. If Aaron orders ham, Chad orders pork.
- ii. Either Aaron or Bob orders ham, but not both.
- iii. Bob and Chad do not both order pork

Let A be the statement 'Aaron orders ham'. Let B be the statement 'Bob orders ham'. And let C be the statement 'Chad orders ham'.

- (a) What does $\sim A$ mean?

- (b) Symbolize statement i.

- (c) Symbolize statement ii.

- (d) Symbolize statement iii.

- (e) Symbolize statement i using only \wedge , \vee , or \sim . (i.e. without using \Rightarrow .)

- (f) Use De Morgan's Laws to symbolize statement iii using only \vee .

- (g) Let $E = i \wedge ii \wedge iii$. Simplify E assuming $A = T$.

- (h) Simplify E assuming $A = F$.

(i) What can we conclude from the previous parts in terms of the problem?

(j) Simplify E assuming $B = F$ (and not knowing anything about A).

(k) Simplify E assuming $B = T$ (and not knowing anything about A).

(l) What can we conclude from the previous parts in terms of the problem?

(m) Simplify E assuming $C = T$ (and not knowing anything about A or B).

(n) Simplify E assuming $C = F$ (and not knowing anything about A or B).

(o) What can we conclude from the previous parts in terms of the problem?

(p) Write a proof of "Aaron eats pork and Bob eats ham".