

**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".