

Solutions to CS 381 Test 1

February 19, 2003

1. Convert the following statements to **if_then form** in English:

- (a) Few people can solve difficult problems.
If problems are difficult, then few people can solve them.
- (b) Healthy diet is necessary for healthy body.
If a body is healthy, then the diet is healthy.
- (c) Further technological advances are possible only if there are free discussions.
If further technological advances are possible, then there are free discussions.
- (d) You can not cash a check which is void. [20]
If a check is void, then you can not cash it.

2. Negate the following statements in English. Give a form other than simply putting "not" or "it is not the case that" in front:

- (a) If today is Tuesday then I have a test in Computer Science or in Biology.
Today is Tuesday and I don't have a test in Computer Science or in Biology.
Or Today is Tuesday and I don't have a test in Computer Science and I don't have a test in Biology.
- (b) Everyone visited some room in this building.
Someone has not visited any room in this building.
- (c) Someone likes it but does not eat it.
Everyone doesn't like it or eats it.
- (d) Tomorrow it is going to rain or snow. [20]
Tomorrow neither it is going to rain nor is it going to snow.

3. Find the converse **and** contrapositive of the following statement in English:

- (a) If it is sunny, people are happy.
Converse: If people are happy, then it is sunny.
Contrapositive: If people are not happy, then it is not sunny.
- (b) Some people like mathematics only if it is fun for them. [20]
Converse: If mathematics is fun for some people then they like it.
Contrapositive: If mathematics is not fun for some people then they don't like it.

4. Find the dual of $[True \wedge (P \vee \neg Q) \wedge \neg(Q \vee False)]$. [5]
 $[False \vee (P \wedge \neg Q) \vee \neg(Q \wedge True)]$

5 (a) Express the argument given below using the symbol suggested for each proposition. [8]

(b) Check whether or not the reasoning is correct using inference rules on the propositions in symbolic form. [12]

Argument:

If I like mathematics(L), then either I study it hard(H) or I enjoy studying it(E). If I enjoy studying mathematics, then I pass the mathematics course(P). If I study mathematics hard, then I don't like mathematics and if I enjoy studying mathematics then I study mathematics hard. But I like mathematics. Therefore I don't pass the mathematics course.

(a)

$$\begin{array}{l} L \rightarrow (H \vee E) \\ E \rightarrow P \\ H \rightarrow \neg L \\ E \rightarrow H \\ L \end{array}$$

$$\neg P$$

(b)

$$\begin{array}{l} H \rightarrow \neg L \\ L \end{array}$$

$$\neg H$$

$$\begin{array}{l} L \rightarrow (H \vee E) \\ L \end{array}$$

$$\begin{array}{l} H \vee E \\ \neg H \end{array}$$

$$\begin{array}{l} E \\ E \rightarrow P \end{array}$$

$$P$$

This P contradicts the conclusion of the argument $\neg P$.

Hence the argument is not correct.

6. Fill in the blanks:

$$\begin{aligned} \text{(a)} \quad & \neg [[P \wedge Q] \rightarrow P] \Leftrightarrow [P \wedge \boxed{Q \wedge \neg P}] \\ \Leftrightarrow & [[P \wedge \boxed{\neg P}] \wedge Q] \Leftrightarrow [\boxed{F} \wedge Q] \\ \Leftrightarrow & \boxed{F} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & [P \wedge \neg [\neg P \wedge Q]] \Leftrightarrow [P \wedge [\boxed{P} \vee \neg Q]] \\ \Leftrightarrow & [[P \vee \boxed{F}] \wedge [P \vee \neg Q]] \Leftrightarrow [P \vee [\boxed{F} \wedge \neg Q]] \\ \Leftrightarrow & [P \vee \boxed{F}] \Leftrightarrow P \end{aligned}$$

$$\text{(c)} \quad [P \vee [Q \wedge R]] \Leftrightarrow [[P \boxed{\vee} \boxed{Q}] \wedge [P \vee R]]$$