

## **Practice Problems on Implication**

### **Problem 1:**

A mother and her son were in the New River Valley Mall. The son was begging for Ice Cream. The mother said to her son,

**“ If you do not behave, I will not buy you any ice cream!”**

A) Which of the following statements are equivalent to the mother’s statement to her son? Justify your answer.

- 1) Behave or no ice cream.
- 2) You must behave before I will buy you any ice cream.
- 3) Your good behavior guarantees some ice cream.
- 4) No ice cream indicates that you are not behaving.
- 5) If I do not buy ice cream then you are not behaving.
- 6) If you have ice cream then you are behaving.
- 7) To have ice cream, good behavior is necessary.
- 8) Behaving well is sufficient for me to buy you ice cream.
- 9) Since you are not behaving, I am not buying ice cream.
- 10) Only if I am buying ice cream are you behaving.
- 11) If I am buying ice cream then you are behaving.

B) 1) If you behave and I do not buy any ice cream have I broken a promise?

2) If the son has ice cream did he behave?

### **Problem 2:** Given the following statements:

P: Tech is #1 in the ACC.

Q: UVA always acts appropriately at all ball games.

R: The Marching Virginias are not good.

W: Tech’s original colors were black and blue.

The statement  $[(P \wedge Q) \vee \sim W] \rightarrow R$  is false and  $\sim Q$  is true. Determine the truth value of P, Q, R and W. Explain in complete sentences your reasoning for each answer.

### **Problem 3:** Use the definition of Nand Operator to prove the following:

$$1) \sim P = P|P \quad 2) P \wedge Q = (P|Q)|(P|Q)$$