**Problem Set 1**

**Part 1 (one point total).** *For each of the following English expressions, determine whether the expression properly expresses a proposition.*

1. Mike likes beer.
2. Meter momma dogface to the banana patch.
3. Where is the bathroom?
4. An isosceles right triangle has two interior angles that are 45 degrees each and one interior angle that is 90 degrees.
5. Do you want another beer?
6. Two plus two equals five.
7. Yes, I would like a beer.
8. Porkchop Sandwiches!
9. George Washington was not the first president of the United States.
10. If I fitz then I sitz. (assume that this non-standard spelling is okay)

Solution:

A proposition is a statement that is true or false, although we don’t have to know which. So questions, exclamations, and imperatives are not logic to properly express a proposition.

Therefore, the expressions 1, 4, 6, 7, 9, 10, express a proposition, but the expressions 2, 3, 5, 8, do not.

**Part 2 (one point total).** *Provide a counterexample for each of the following invalid arguments to show that it is invalid.*

*Example-*

*Argument 0*

*1. Mike is a political science grad student or he is a lawyer.*

*2. Mike is a political science grad student.*

*Therefore, Mike is not a lawyer.*

One counterexample for this argument occurs when Mike is both a lawyer and a political science grad student. That would make both premises true and the conclusion false.

Argument 1

1. If it’s raining, then the streets are wet.

2. The streets are wet

Therefore, it’s raining.

- One counterexample for this argument occur when the sprinkler system is turned on, that makes the streets wet, although it is not raining. That would make both premises true and the conclusion false.

Argument 2

1. If it’s raining, then the streets are wet.

2. It’s not raining.

Therefore, the streets are not wet.

- One counterexample for this argument occur when the sprinkler system is turned on, that makes the streets wet, although it is not raining. That would make both premises true and the conclusion false.

Argument 3

1. Dr. Goldsby teaches in Pullman or he teaches at WSU.

2. Dr. Goldsby teaches at WSU.

Therefore, he does not teach in Pullman.

- One counterexample for this argument occur when Dr. Goldsby teaches at WSU, which is also in Pullman, thus it would make both premises true and the conclusion false.

Argument 4

1. Hilary or Josiah is a TA for logic.

2. Hilary is a TA for logic.

Therefore, Josiah is a TA for logic.

- One counterexample for this argument occur when Hilary is a TA for logic and Josiah is not a TA for logic, but for another subject like music. That would make both premises true and the conclusion false.

Argument 5

1. All lagers are beers.

2. All ales are beers.

3. All stouts are ales.

Therefore, all stouts are lagers.

- One counterexample for this argument occur when all stouts are ales, all ales are beers, but all lagers are another kind of beers, which is not the same type with ales. So all stouts are not lagers. That would make both premises true and the conclusion false.

**Part 3 (one point total).** *For the first two problems, complete the definition. For each of the logical symbols below, provide a one-word translation into English.*

1. An argument is **valid** if and only if …

2. An argument is **sound** if and only if …

3. ~

4. &

5. ∨

Solution:

1. An argument is **valid** if and only if it is impossible for the premises to be true while the conclusion is false.
2. An argument is **sound** if and only if it is valid, and its premises are true.
3. Negation
4. Conjunction
5. Disjunction

**Part 4 (one point total).** *For each of the following sentences, determine whether they are true or false.*

1. All arguments must have a set of premises, but the set can be empty.
2. All invalid arguments have false conclusions.
3. All sound arguments are valid.
4. A valid argument can have a false conclusion.
5. The premises of a sound argument entail their conclusion.
6. A valid argument can have false premises.
7. A sound argument can have false premises.
8. Every argument must have at least two sentences.
9. Every argument has a conclusion.
10. The conclusion of a sound argument must be true.

Solution:

1. True
2. False
3. True
4. True
5. True
6. True
7. False
8. True
9. True
10. True