Logic 120 - Work Sheet

Revised September 8, 2009

Valid Argument Forms:
When the "P's" and "Q's" are replaced by sentences which are true or false (a.k.a. propositions) then each resulting argument *must be valid*. The traditional name for each valid type is given in italics (no need to memorize these names):

Modus Ponens

If P, then Q
P
Therefore Q

Example:

If John gets a raise, then he will take us all out to dinner
John gets a raise
Therefore he will take us all out to dinner

Modus Tollens

If P, then Q
Not Q
Therefore Not P

Example:

If Gravity is equivalent to the curvature of space-time, then light will be bent as it passes by a large gravitational object.
Light is not bent as it passes by a large gravitational object.
Therefore Gravity is not equivalent to the curvature of space-time.

Hint: Do not let the language fool you - go back and carefully re-read the argument, and you will find that:
P = " Gravity is equivalent to the curvature of space-time"
Q= "light will be bent as it passes by a large gravitational object"

Hypothetical Syllogism

If P then Q
If Q then R
P
Therefore R

Example:

If Congress passes the new transportation bill, then we can expect more jobs in the road-construction sector.
If there are more jobs in the road-construction sector, then John will have a good chance at getting hired.
Congress did pass the new transportation bill
Therefore John has a good chance of getting hired.

Disjunctive Syllogism (a.k.a. the process of elimination)

P or Q
Not P
Therefore Q

Example:

Either the cord is unplugged or the power is out
The chord is not unplugged
Therefore the power is out.

Conjunction

P
Q
Therefore P and Q

Example:

Chess uses the same board as checkers
In Chess, white moves first
Therefore Chess uses the same board as checkers and white moves first.

The following argument forms will be considered invalid for this class (we might see later that sometimes these forms can be valid, but for now do not worry about it)

Denying the Antecedent

If P, then Q
Not P
Therefore Not Q

Example:

If there is a security breach at the airport, my flight will be delayed.
There was not a security breach at the airport.
Therefore my flight was not delayed.

Explanation:
Flights can be delayed for other reasons besides security breaches (weather, mechanical problems, pilot sickness, scheduling errors, etc)

Affirming the Consequent

If P, then Q
Q
Therefore P

Example:

If you go to Coffee Exchange, you can buy a large iced-coffee.
Sally bought a large iced coffee
Therefore Sally went to Coffee Exchange

Explanation: Sally bought her iced coffee at Epic Café.

False-Dichotomy

P or Q
P
Therefore Not Q

Example:

To get a driver's license in a foreign country you must have a valid drivers license in the United States or be over 21.
John has a valid drivers license in the U.S.

Therefore John is not over 21

Explanation: The "or" is inclusive (and/or), rather than exclusive (or, but not both) - in this case, John is both over 21 and has a valid driver's license.

Other Rules of thumb:

In general, an argument with a single premise and a single conclusion will be invalid.

Example:
If you take Bextra, you will feel better in the morning.

In general, arguments with tense (past to future) will be invalid.

Example:
It rained every day this week, therefore it will rain tomorrow.

Other Reminders.

- Arguments *as a whole* are either invalid or valid.
- Individual elements of an argument (premises and conclusions) are either true or false.
- Remember the IF in each definition of valid and invalid.
- Remember invalid does not mean "bad" or "false" - as the most common form of good reasoning is strong induction, which is invalid but provides very good reasons for accepting the conclusion.
- Fallacious arguments (or just an argument Fallacy) does not mean the conclusion is false - only that the argument as stated provides no reason to accept the truth of the conclusion.

Exercises:

Determine whether the following arguments are valid or invalid. Justify your answer by appealing to one of the logical forms above:

1)
If it rains, then it pours.

2)
If the television is not working, then we will watch the show at Jims.
We did not watch the show at Jims
Therefore the television is working.

3)
Either the cord is unplugged or the fuse is blown.
The cord is plugged in
Therefore the fuse is blown.

4)
If gas prices continue to rise, then transportation costs will rise also.
If transportation cost rise, then the cost of food will go up too.
Gas prices continue to rise
Therefore, the cost of food will go up.

5)
John bought a Toyota or a Ford
He bought a Toyota
Therefore he did not buy a Ford

6)
If the weather turns bad, then our flight will be delayed.
Our flight was delayed
Therefore the weather turned bad.

7)
If the contestant picks door number 3, then she will win a new car.
The contestant picks door number 3
Therefore the contestant wins a new car.

8)
Manatees are mammals
Dolphins are mammals too
Hence both manatees and dolphins are mammals.

9)
If John runs a mile a day, he will be in shape in time for the race.
John did not run a mile a day
Hence he will not be in shape in time for the race.