

MATH/EECS 1028: DISCRETE MATH FOR ENGINEERS
WINTER 2015
Tutorial 3 (Week of Jan 26, 2015)

Notes:

1. Assume $\mathbb{R}$ to denote the real numbers, $\mathbb{Z}$ to denote the set of integers $(\dots, -2, -1, 0, 1, 2, \dots)$ and $\mathbb{N}$ to denote the natural numbers $(1, 2, 3, \dots)$.
2. Topics: Sequences, Logic.
3. Note to the TA: Attendance will be taken this week. No quiz this week.

Questions:

1. (a) Write down the truth table for the following proposition. Then indicate whether is a tautology, contradiction or neither.

$$(p \wedge q) \rightarrow (p \rightarrow q)$$

- (b) Let p, q, r be the propositions:

p : You have the flu

q : You miss the final examination

r : You pass the course.

Write the following proposition as an English sentence.

$$(p \rightarrow \neg r) \vee (q \rightarrow \neg r)$$

2. Form the contrapositive of these statements:
 - (a) If you don't take the final examination, you will get an F for the course.
 - (b) If a quadrilateral is a rectangle, it has 4 equal angles.
 - (c) If a triangle has either two equal sides or two equal angles, then it is an isosceles triangle.
3. Decide whether the following statements are tautologies or contradictions or neither. Prove your answer in each case.
 - (a) $(p \rightarrow q) \vee (q \rightarrow p)$.
 - (b) $(p \wedge q) \vee (q \rightarrow \neg p)$.
 - (c) $(p \vee \neg q) \rightarrow (q \wedge \neg p)$.
4. Each argument below is either correct or it has a fallacy (but not both!). Write the argument in symbols and then determine whether the argument is valid. If it is valid, write whether it uses *modus ponens* or *modus tollens*.

- (a) If both numbers are even, then the sum is even. They are not both even. Therefore the sum is not even.
- (b) If this University is large, then it has large departments. This University has large departments. Therefore, it is large.
5. Find the sum of all integers between 1 and 100 that leave remainder 2 upon division by 6.
6. Find the sum
- $$S = 5 + 55 + 555 + \dots + 5 \dots 5 (\text{n } 5\text{'s})$$
7. The first four terms of an arithmetic sequence (in order) are $x + y, x - y, xy$ and x/y . What is the value of the fifth term?
8. Find a formula, in terms of n , for the sum of the first n terms of the sequence

$$1, 1 + 2, 1 + 2 + 2^2, 1 + 2 + 2^2 + 2^3, \dots$$