

# Math 512 Homework 1

January 23, 2013

- Write the following sentences as statement forms, using statement letters to stand for the atomic sentences – that is, those sentences that are not built up out of other sentences.
  - If Mr. Jones is happy, Mrs. Jones is not happy, and if Mr. Jones is not happy, Mrs. Jones is not happy.
  - Either Sam will come to the party and Max will not, or Sam will not come to the party and Max will enjoy himself.
  - A sufficient condition for  $x$  to be odd is that  $x$  is prime.
- Determine whether the following are tautologies.
  - $(A \Rightarrow (B \Rightarrow (B \Rightarrow A)))$
  - $((A \Rightarrow B) \vee (B \Rightarrow A))$
  - $(A \Rightarrow \neg B) \Rightarrow (A \vee B)$
- Show that the following wffs are logically equivalent.
  - $A \wedge (B \vee C)$  and  $(A \wedge B) \vee (A \wedge C)$
  - $\neg(A \vee B)$  and  $(\neg A) \wedge (\neg B)$
  - $A \Rightarrow B$  and  $\neg B \Rightarrow \neg A$
- Show that  $A \wedge B$  can be expressed using  $\neg$  and  $\vee$ .
- Translate the following into wffs:
  - Not all birds can fly.
  - Nobody loves a loser.
  - You can fool some of the people all the time, and you can fool all the people some of the time, but you can't fool all the people all the time.
- By introducing appropriate notation, write the arguments as wffs and determine whether the argument is correct; i.e. determine whether the conclusion is logically implied by the conjunction of the premises.
  - If Jones is a communist, Jones is an atheist. Jones is an atheist. Therefore, Jones is a communist.
  - If Gorton wins the election, then taxes will increase if the deficit will remain high. If Gorton wins the election, the deficit will remain high. Therefore, if Gorton wins the election, taxes will increase.
  - Smith cannot both be a running star and smoke cigarettes. Smith is not a running star. Therefore, Smith smokes cigarettes.
  - All scientists are neurotic. No vegetarians are neurotic. Therefore, no vegetarians are scientists.
  - All men are animals. Some animals are carnivorous. Therefore, some men are carnivorous.