Tutorial 2 – Propositional Logic

Exercise 1:   Determine the truth function, decide whether the formula is satisfiable, a tautology or a contradiction using contradiction.

a) $(p \wedge \neg q) \supset (\neg p \supset (q \vee p))$

b) $[(p \vee \neg q) \wedge \neg (p \wedge q)] \supset (\neg p \vee q)$

c) $(p \supset q) \wedge (p \wedge \neg q)$

d) $(p \supset q) \supset (\neg q \supset \neg p)$

Exercise 2:
Verify the (in)validity of arguments.

a) If I'm good, I'll get an iPhone.
   I'll be good.
   ――――――――――――――――――――――――
   I'll get an iPhone.

b) The sun doesn't shine or I wear sunglasses.
   The sun's not shining.
   ――――――――――――――――――――――――
   I don't wear sunglasses.

c) He's in class or wandering around school.
   If he's in class, he's a model student.
   ――――――――――――――――――――――――
   If he's not a model student, then he's wandering around school.

d) If I address the problem, I solve the problem.
   If I'm not attending to the problem, then I have something else to do.
   ――――――――――――――――――――――――
   I'll solve the problem or I've got something else to do.

e) If I work, then I make money, but if I'm lazy, then I enjoy.
   Either I work or I'm lazy.
   However, if I'm lazy, then I don't earn, while if I work, then I don't enjoy.
   ――――――――――――――――――――――――
   That's why I enjoy.

f) The sun is shining and it's raining.
   It's not raining.
   _____

   I'm drinking beer.

Remark: Transformation rules.

$(\alpha \equiv \beta) \Leftrightarrow (\alpha \supset \beta) \wedge (\beta \supset \alpha)$	
$(\alpha \supset \beta) \Leftrightarrow (\neg\alpha \vee \beta)$	
$\neg(\alpha \supset \beta) \Leftrightarrow (\alpha \wedge \neg\beta)$	Negation of implication
$\neg(\alpha \wedge \beta) \Leftrightarrow (\neg\alpha \vee \neg\beta)$	De Morgan
$\neg(\alpha \vee \beta) \Leftrightarrow (\neg\alpha \wedge \neg\beta)$	De Morgan
$\neg\neg\alpha \Leftrightarrow \alpha$	

Exercise 3:   Negate: (verbally and formally)

a) I'll walk or sing.

b) Pavel is not a Sparta or Slavia fan.

c) If it's Wednesday, it's a meeting.

d) Only when I'm writing the program do I think if it works.

e) The programme works when it's written properly.

f) If I don't spend enough time on the solution, the result is uncertain and I have to start again.

g) I can program in Java, but I don't know C++ syntax.

h) Peter and Pavel believe in the future of IT, Tomas and Emil shake their heads.

i) If you get good results, you won't have a problem at school and you'll be fine.