Reading Week Assignment CS1003

(Do All Four Questions)

1. Let the set operator, $\bar{\cap}$ be defined so that

$$X \bar{\cap} Y = \overline{X \cap Y}$$

where the set $\overline{X}$ is the complement of the set X .
Determine by Karnaugh Map whether:

(a) $A \cap B = (A \bar{\cap} B) \bar{\cap} (A \bar{\cap} B)$

(b) $A \cup B = (A \bar{\cap} A) \bar{\cap} (B \bar{\cap} B)$

(c) $A \bar{\cap} (B \bar{\cap} C) = (A \bar{\cap} B) \bar{\cap} C$

2. A survey was made of a group of 120 students studying in 3 courses:
Anatomy, Biology and Chemistry.
All 120 students are studying at least one of the 3 courses.

- 24 students study only Chemistry.
- 20 students study all 3 courses.
- 8 students study Anatomy and Chemistry but not Biology.
- 60 students study Chemistry.
- 8 students study only Anatomy.
- 12 students study only Biology.

(a) How many students study Anatomy and Biology but not Chemistry?

(b) How many students study Anatomy?

3.

(a) Determine using truth tables or otherwise, whether the following are Tautologies

i. $(p \to q) \to p$
ii. $(p \wedge (q \equiv r)) \to ((p \wedge q) \equiv (p \wedge r))$

(b) Determine by Truth Table or otherwise, whether the following argument is valid

The programmer is careful or if the program crashes then the specification is not clear.
If the programmer is careful then the program does not crash.
The program crashes.
$\therefore$
If the specification is clear then the programmer is careful.

Abbreviate:
P: The programmer is careful.
S: The specification is clear.
C: The program crashes.

4. Show by KE Deduction,

   (a) that the following following is a valid argument i.e. the conjecture can be inferred from the premise.

   Premise
   $\neg J \to F \land G$

   Conjecture
   $G \to F \lor J$

   i.e. show $\neg J \to F \land G \vdash G \to F \lor J$

   (b) $\vdash ((p \to q) \land (p \lor r)) \lor (p \land \neg q) \lor \neg(p \lor r)$

KE Deduction Rules

	Double Negation
Premise	$\neg\neg P$
Conclusion	P

	$\alpha - rules$	
Premise	$P \land Q$	$P \land Q$
Conclusion	P	Q
Premise	$\neg(P \lor Q)$	$\neg(P \lor Q)$
Conclusion	$\neg P$	$\neg Q$
Premise	$\neg(P \to Q)$	$\neg(P \to Q)$
Conclusion	P	$\neg Q$

		$\beta - rules$		
Premise	$P \lor Q$	$\neg(P \land Q)$	$P \to Q$	$P \to Q$
Premise	$\neg P$	P	P	$\neg Q$
Conclusion	Q	$\neg Q$	Q	$\neg P$

Branching Rule:

P $\neg$P