

# Reading Week Assignment CS1003

**Due** 12noon, Thursday, 9th March

(Do All Three Questions)

1.

- (a) Let the set operator,  $\bar{\cup}$  be defined so that

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

where the set  $\bar{X}$  is the complement of the set  $X$ .

Determine by Veitch diagram whether:

- i.  $A\cup B = A\bar{\cup}(A\bar{\cup}B)$
  - ii.  $\overline{A\cap B} = \bar{A}\bar{\cup}(B\bar{\cup}A)$
  - iii.  $A\bar{\cup}(B\bar{\cup}C) = (A\bar{\cup}B)\bar{\cup}C$
- (b) A survey was made of a group of 30 students concerning the 3 societies:  
Archaeological, Botany and Choral.  
All the members of the group of 30 students belong to at least one society.
- 6 students belong to only the Choral society.
  - 5 students belong to all 3 societies.
  - 2 students belong to the Archaeological and Choral societies but not to the Botany society.
  - 15 students belong to the Choral society.
  - 2 students belong only to the Archaeological society.
  - 3 students belong only to the Botany society.
- i. How many students belong to the Archaeological society and Botany society but not the Choral society?
  - ii. How many students belong to the Archaeological society?

2.

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

- i.  $(p \rightarrow q) \rightarrow p$
- ii.  $(p \rightarrow q \wedge r) \rightarrow (p \rightarrow q) \wedge (p \rightarrow r)$

- (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.*

### 3. The Tardy Bus Problem

The following three statements are given as premises:

*If Bill takes the bus then, Bill misses his appointment if the bus is late.*

*Bill does not go home, if Bill misses his appointment and Bill feels downcast.*

*If Bill does not get the job then, Bill feels downcast and Bill goes home.*

Determine, by the use of KE Deduction, whether each of the following 2 conjectures can be inferred from the premises.

- (a) *If Bill goes home then he either feels downcast or he gets the job..*
- (b) *If Bill takes the bus and he does not go home then, he gets the job if he does not miss his appointment.*

#### Abbreviations:

TB: *Bill Takes the Bus.*

MA: *Bill Misses his Appointment*

BL: *The Bus is Late.*

GH: *Bill Goes Home.*

FD: *Bill Feels Downcast.*

GJ: *Bill Gets the Job.*

Translations of Premises

P1:  $TB \rightarrow BL \rightarrow MA$

P2:  $MA \wedge FD \rightarrow \neg GH$

P3:  $\neg GJ \rightarrow FD \wedge GH$

Translation of Conjectures.

(a)  $GH \rightarrow FD \vee GJ$

(b)  $TB \wedge \neg GH \rightarrow \neg MA \rightarrow GJ$

#### KE\_Deduction Rules

$\alpha$ – rules				
Premise	$\neg\neg P$	$P \wedge Q$	$\neg(P \vee Q)$	$\neg(P \rightarrow Q)$
Conclusion	$P$	$P$	$\neg P$	$P$
Conclusion		$Q$	$\neg Q$	$\neg Q$

$\beta$ – rules				
Premise	$P \vee Q$	$\neg(P \wedge Q)$	$P \rightarrow Q$	$P \rightarrow Q$
Premise	$\neg P$	$P$	$P$	$\neg Q$
Conclusion	$Q$	$\neg Q$	$Q$	$\neg P$

#### Branching Rule

$$\begin{array}{c} \wedge \\ P \quad \neg P \end{array}$$