## **Logic Tutorial 2**

1. An Exercise taken from Year 1 Logic – with my thanks to Prof. Ian Hodkinson

Consider a set of objects labelled A, B, C, ... placed on a 3\*3 grid, and the following atomic formulas talking about the objects:

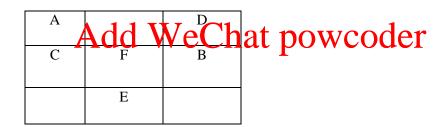
[x next-to y] means (that is, it is true if) x and y are adjacent (horizontally or vertically, but not diagonally);

[x sees y] means x and y are in the same row or the same column;

[x left-of y] means x is in a column to the left of the column of y;

[x above y] means x is in a row above the row of y.

- (a) For the placements shown in figure below, which of the following evaluate to true, and why?
  - i. [A seA By Significant Project Exam Help
- iii.  $\neg ([A \text{ left-of } F] \land [F \text{ above } A])$
- iv.  $\neg ([E \text{ left-of D}] \rightarrow \neg [D \text{ next-to } C]) \rightarrow \neg [A \text{ sees E}]$
- v. ([E sees D] v [Fretps://powebetcicom



- (b) Place the 6 objects A, ..., F on the grid so that all the formulas above are true.
- 2. For each of the following determine if it is a tautology, inconsistency or contingency by drawing the truth table.

a. 
$$P \wedge (P \vee Q)$$

d. 
$$(P \land (Q \lor P)) \leftrightarrow P$$

b. 
$$(P \lor Q) \land (P \rightarrow Q)$$

e. 
$$(P \rightarrow O) \rightarrow (\neg P \lor O)$$

c. 
$$Q \land \neg P \land (P \lor (Q \rightarrow P))$$

f. 
$$((P \rightarrow Q) \land (R \rightarrow S) \land (P \lor R)) \rightarrow (Q \lor S)$$