Tutorial 1

Rule-Based Systems & Search

1. Draw a graph that describes the way the following rules link the set of facts (propositions) **A, B, C, D, E, F, K, L, M, G1, G2.**

R0:	If	**A**	Then	**K**
R1:	If	**K B C**	Then	**L**
R2:	If	**B C E**	Then	**M**
R3:	If	**C F**	Then	**N**
R4:	If	**L E**	Then	**G1**
R5:	If	**M N**	Then	**G2**
R6:	If	**M F**	Then	**G1**
R7:	If	**B D**	Then	**L**

2. In a forward-chaining system that uses a conflict resolution criteria of firing the rule that is most recently instantiated, suggest a possible order in which these rules would fire given that the following facts are asserted in the beginning:-

   A, B, C, D, E, F

   Assume that when a conflict remains with this criteria it is resolved by choosing the rule with the most complex premise. Assume any further conflicts are resolved at random.

3. In a backward-chaining system that starts by attempting to prove **G1** describe the order in which the rules will be explored using depth-first search.

   Repeat the exercise in Q3 using breadth-first search.

6. (a) Below we have a simple rule-based system for selecting a holiday. In this system the goals are the available holiday destinations and a forward-chaining inference mechanism is to be used. If rule inference is to continue until all possible goals are derived show the order in which goals will be derived. Consider that conflict resolution gives priority to most recently instantiated rules first and to rules with most complex premise after that.

```
Goals: NileCruise, Majorca, Crete, DivingAustralia,
BallyBunnion
Available Facts: SpanishSpeaking, Budget,
Nightlife,SunSeaSand

R1  If   Budget and
         SunSeaSand and
         Nightlife
    Then SunPackage
```

```
R2  If   Budget and
         SunSeaSand
    Then BallyBunnion

R3  If   MoneyNoObject
    Then LongHaul

R4  If   Adventure and
         LongHaul and
         SunSeaSand
    Then DivingAustralia

R5  If   NightLife and
         SunPackage
    Then Majorca and Crete

R6  If   NightLife and
         SunPackage and
         SpanishSpeaking
    Then Majorca

R7  If   Culture and
         MoneyNoObject
    Then NileCruise
```

(b) In this example the `SunPackage` feature is an *internal* feature – i.e. it is not an input feature or a goal. Would there be a role for this feature in a case-based solution to the same problem? Explain your answer.

5. A commercial traveller has to visit customers in Dublin, Galway, Tullamore, Longford and Kilkenny. She is currently in Dublin and needs to determine the order to do the visits that will minimise time spent travelling. She can come back to Dublin at her leisure. The following matrix shows the estimated time between towns:-

	DB	**TM**	**KK**	**LD**	**GY**
DB	-	80	100	130	200
TM	80	-	50	70	130
KK	100	50	-	160	170
LD	130	70	160	-	110
GY	200	130	170	110	-

If this problem is to be solved using Branch & Bound Search show the order in which branching will be done until the first complete candidate solution is found. Show the partial solutions that can be bound out at this stage.