

*Ollscoil na hÉireann, Gaillimh*  
*National University of Ireland, Galway*  
**Semester II Examinations 2005/ 2006**

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**Exam Code(s)** 11F 1  
**Exam(s)** B.Sc. in Information Technology

**Module Code(s)** CT108  
**Module(s)** Next Generation Technologies I

Paper No. 1  
Repeat Paper

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**Instructions:** Answer questions from all 4 sections.  
Use separate answer books for each section.  
Answer **one** question within each section.  
All questions carry equal marks.

**Duration** 3 hours  
**No. of Pages** 6  
**Department(s)** Information Technology  
**Course Co-ordinator(s)**

**Requirements:**

MCQ  
Handout  
Statistical Tables  
Graph Paper  
Log Graph Paper  
Other Material

## Section A: The Semantic Web

### Question 1

- a) Some popular examples of sites offering “Web 2.0” functionality are *del.icio.us*, *Flickr* and *Wikipedia*. Detail some of the features of these sites, and give an example of how a Web 2.0 community site could be created to aid people in finding popular restaurants and bars in Galway City.

10 MARKS

- b) What is the difference between an XML document and an XSL stylesheet? In the XML document “books.xml” as shown below, identify (one example each of) an (i) entity, (ii) an XML header, (iii) an element, (iv) a processing instruction or directive and (v) an attribute.

10 MARKS

```
<?xml version="1.0"?>
<?xml-stylesheet type="text/xsl" href="books.xsl"?>
<library>
  <book title="XML" author="Gregory Brill">
  </book>
  <book>
    <title>Java & XML</title>
    <author>Brett McLaughlin</author>
  </book>
</library>
```

### Question 2

- a) Define the term “blog”, and describe some of the main features of blog sites. Explain what RSS is and give some examples of what RSS can be used for.

10 MARKS

- b) Describe an NUI Galway metadata instance of the University class using RDF where the instance has the following properties (Table 1):

10 MARKS

Property	Value
rdf:type	<a href="http://reliant.teknowledge.com/DAML/Mid-level-ontology.owl#PostSecondarySchool">http://reliant.teknowledge.com/DAML/Mid-level-ontology.owl#PostSecondarySchool</a>
full_name	National University of Ireland, Galway
abbreviation	NUI Galway
homepage	<a href="http://www.nuigalway.ie/">http://www.nuigalway.ie/</a>
presidents_name	Professor Iognáid Ó Muirheartaigh
presidents_homepage	<a href="http://www.nuigalway.ie/president/">http://www.nuigalway.ie/president/</a>
total_number_of_students	15,000
date_established	1845
location	Galway, Republic of Ireland

Table 1: Properties for an instance of type University

## Section B: Artificial Intelligence

### Question 3

- a) What do you understand by the term computer game?  
5 MARKS
- b) Consider a machine that accepts payment for parking. It gives no change. It only accepts 10, 20, and 50 cent coins. If the cost of your parking is 40 cent, show the different ways that the amount necessary can be accepted by the machine.  
10 MARKS
- c) Would the type of machine in (b) be of any use in computer games in your view?  
5 MARKS

### Question 4

- a) Consider the following maze and obstacles, where an obstacle is given by an uppercase letter placed in a cell:

		A	N				
			A				
☺			S				food
			T				
		W	Y			L	
						L	
						A	
						W	
						A	

The smiley located at the left of the maze wants to get to the food at the right. The smiley may move as follows.

Rule for movement:

- 1 Walk one cell at a time.
- 2 Walk east. If blocked, walk north. If blocked, walk west. If blocked walk south. If blocked go back to beginning of rule 2 and walk east again.

Show what happens to the smiley walking through the maze, stating your assumptions.

10 MARKS

- b) Suggest some movement rule or rules of your own such that the smiley can in fact get to the food.

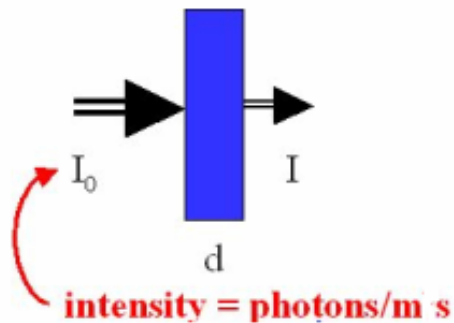
10 MARKS

## Section C: Scientific Computing

### Question 5

You have been sent to Radiology Department in the hospital for your 3rd year placement. Whilst there, there is an accident and the container for a radioactive source breaks. You are asked to calculate the optimum thickness of a sheet of lead which will be used to absorb excess radiation until a new container is delivered.

The following diagram shows the drop in intensity of photons as they pass through a barrier of thickness  $d$ . More specifically, the intensity is  $I(x=0)$  at one side, and  $I(x=d)$  at the other.



The equation which defines the intensity drop across a barrier of size  $d$  is as follows:

$$\frac{dI}{dx} = -kI(x)$$

where  $I(x)$  is the intensity at a distance  $x$  into the barrier and  $k$  represents the opacity of the barrier per unit distance.

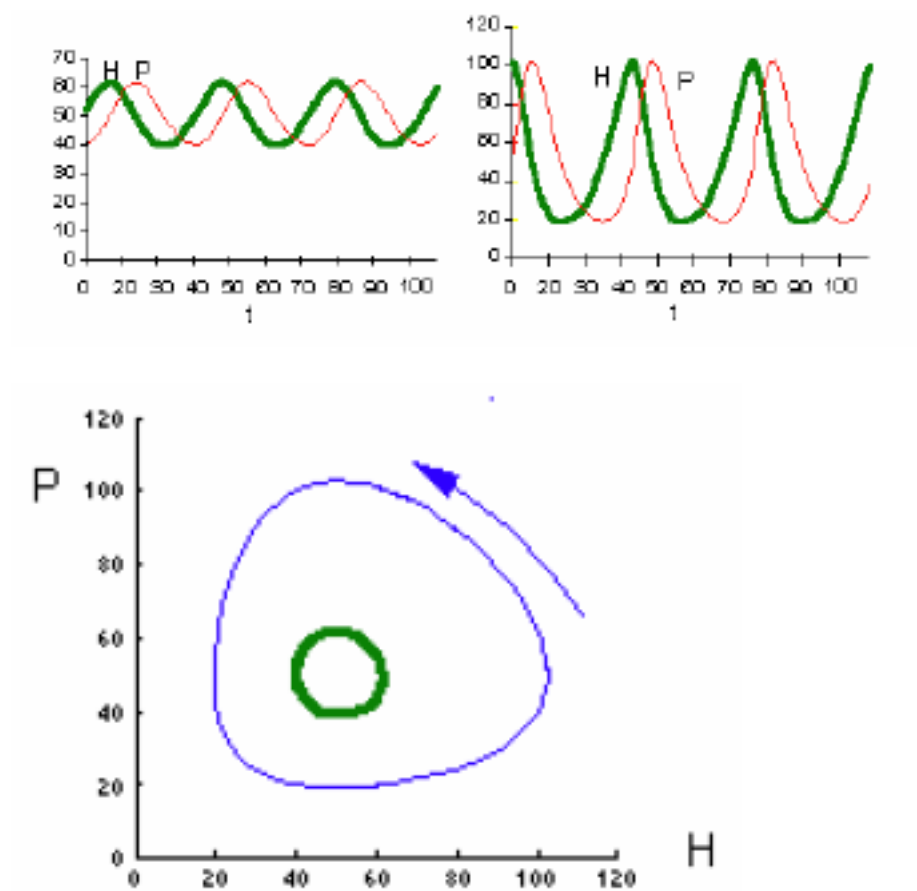
Say the intensity of the radiation exposed is 1000 units/sec, and the hospital want it reduced to 1 unit/sec, and you've been told the opacity of the lead to be used is 10 units/m.

Show how you would solve this equation numerically using Euler's Method - can you estimate the thickness of lead needed?

20 MARKS

### Question 6

In the Lotke-Volterra equations, we study two parameters, the populations of the predator and prey as a function of time. Whilst its possible to plot the two populations as a function of time on the same graph (as below), it is also possible to plot the two populations on their own graph, in what is known as phase space. Why is this useful? What does it tell us about a complicated system that can be based on the Lotke-Volterra system? Illustrate your answer with observational evidence for the latter.



20 MARKS

## Section D: Medical Informatics

### Question 7

- a) What do you understand by the term *medical informatics*?

5 MARKS

- b) Assume that the Department of Health and Children hires you as an IT consultant. Your job is to look into the area of Diabetes and to evaluate, how Medical Informatics is already used or can be used to provide a better service for the management and treatment of patients with this disease. Your assessment should be based on the Model for Structuring Computer Applications in Health Care and should suggest one application for each of the six layers of the model.

15 MARKS

### Question 8

- a) In your job as an IT-consultant you try to convince the Minister of Health to provide funding for the introduction of a computer-based Patient Medical Record System in all major hospitals. Therefore assess and outline weaknesses of traditional (paper-based) medical record systems. Use examples to illustrate your arguments?

8 MARKS

- b) The Government provides you with funding to tackle three common diseases among the Irish population, e.g. Diabetes, Hypertension and cardiac diseases.
- What are the risks and long-term complications that are associated with these diseases?
  - Which kind of medical devices would you use to assess groups at risk?
  - What kind of information do these devices provide?
  - What can the government do to reduce the number of incidences in the future?

12 MARKS