THE DEPARTMENT OF ADVANCED SCIENCE AND TECHNOLOGY
UNIVERSITIES OF COMPUTER STUDIES, ZONE IV
Honours (B.C.Sc. / B.C.Tech.)
FIRST SEMESTER EXAMINATION
MARCH 2014

Answer all questions. **ENGLISH** **Time allowed: 3 hours**

QUESTION-I

In 1907, Leo Hendrick Baekeland, a Belgian scientist working in New York, discovered and patented revolutionary new synthetic material. His invention, which he named 'Bakelite', was of enormous technological importance, and effectively launched the modern plastics industry. The term 'plastic' comes from the Greece *plassein*, meaning 'to mould'. Some plastics are derived from natural sources, some are semi-synthetic (the result of chemical action on a natural substance), and some are entirely synthetic, that is, chemically engineered from the constituents of coal or oil. Some are 'thermoplastic', which means that, like candlewax, they melt when heated and can then be reshaped. Others are 'thermosetting': like eggs, they cannot revert to their original viscous state, and their shape is thus fixed for ever. Bakelite had the distinction of being the first totally synthetic thermosetting plastic.

The history of today's plastics begins with the discovery of a series of semi-synthetic thermoplastic materials in the mid-nineteenth century. The impetus behind the development of these early plastics was generated by a number of factors – immense technological progress in the domain of chemistry, coupled with wider cultural changes, and the pragmatic need to find acceptable substitutes for dwindling supplies of 'luxury' materials such as tortoiseshell and ivory.

Baekeland's interest in plastics began in 1885 when, as a young chemistry student in Belgium, he embarked on research into phenolic resins, the group of sticky substances produced when phenol (carbolic acid) combines with an aldehyde (a volatile fluid similar to alcohol). He soon abandoned the subject, however, only returning to it some years later. By 1905 he was a wealthy New Yorker, having recently made his fortune with the invention of a new photographic paper. While Baekeland had been busily amassing dollars, some advances had been made in the development of plastics. The years 1899 and 1900 had seen the patenting of the first semi-synthetic thermosetting material that could be manufactured on an industrial scale. In purely scientific terms, Baekeland's major contribution to the field is not so much the actual discovery of the material to which he gave his name, but rather the method by which a reaction between phenol and formaldehyde could be controlled, thus making possible its preparation on a commercial basis. On 13 July 1907, Baekeland took out his famous patent describing this preparation, the essential features of which are still in use today.

The original patent outlined a three-stage process. in which phenol and formaldehyde (from wood or coal) were initially combined under vacuum inside a large egg-shaped kettle. The result was a resin known as Novalak, which became soluble and malleable when heated. The resin was allowed to cool in shallow trays until it hardened, and then broken up and ground into powder. Other substances were then introduced: including fillers, such as woodflour, asbestos or cotton, which increase strength and moisture resistance, catalysts (substances to

speed up the reaction between two chemicals without joining to either) and hexa, a compound of ammonia and formaldehyde which supplied the additional formaldehyde necessary to form a thermosetting resin. This resin was then left to cool and harden, and ground up a second time. The resulting granular power was raw Bakelite, ready to be made into a vast range of manufactured objects. In the last stage, the heated Bakelite was poured into a hollow mould of the required shape and subjected to extreme heat and pressure, thereby 'setting' its form for life.

The design of Bakelite objects, everything from earrings to television sets, was governed to a large extent by the technical requirements of the moulding process. The object could not be designed so that it was locked into the mould and therefore difficult to extract. A common general rule was that objects should taper towards the deepest part of the mould, and if necessary the product was moulded in separate pieces. Moulds had to be carefully designed so that the molten Bakelite would flow evenly and completely into the mould. Sharp corners proved impractical and were thus avoided, giving rise to the smooth, 'streamlined' style popular in the 1930s. The thickness of the walls of the mould was also crucial: thick walls took longer to cool and harden, a factor which had to be considered by the designer in order to make the most efficient use of machines.

Baekeland's invention, although treated with disdain in its early years, went on to enjoy an unparalleled popularity which lasted throughout the first half of the twentieth century. It became the wonder product of the new world of industrial expansion – 'the material of a thousand uses'. Being both non-porous and heat-resistant, Bakelite kitchen goods were promoted as being germ-free and sterilisable. Electrical manufacturers seized on its insulating properties, and consumers everywhere relished its dazzling array of shades, delighted that they were now, at last, no longer restricted to the wood tones and drab browns of the pre-plastic era. It then fell from favour again during the 1950s, and was despised and destroyed in vast quantities. Recently, however, it has been experiencing something of a renaissance, with renewed demand for original Bakelite objects in the collectors' marketplace, and museums, societies and dedicated individuals once again appreciating the style and originality of this innovative material.

Questions 1-5

Complete the summary.

*Choose **ONE WORD ONLY** from the passage for each answer.*

Some plastics behave in a similar way to **1**..... in that they melt under heat and can be moulded into new forms. **2**..... was unique because it was the first material to be both entirely **3**..... in origin, and thermosetting.

There were several reasons for the research into **4**..... in the nineteenth century, among them the great advances that had been made in the field of **5**..... and the search for alternatives to natural resources like ivory.

Questions 6-7

*Choose **TWO** letters A-E.*

Which **TWO** of the following factors influencing the design of Bakelite objects are mentioned in the text?

A the function which the object would serve

B the ease with which the resin could fill the mould

C the facility with which the object could be removed from the mould

D the limitations of the materials used to manufacture the mould

E the fashionable styles of the period

Questions8-10

Do the following statements agree with the information given in Reading Passage?

TRUE if the statement agrees with the information

FALSE if the statement contradicts the information

NOT GIVEN if there is no information on this

8 Modern-day plastic preparation is based on the same principles as that patented in 1907.

9 Bakelite was immediately welcomed as a practical and versatile material.

10 Bakelite was only available in a limited range of colours.

QUESTION-II

Complete the paragraph using the list of words below.

extinction	dinosaurs	obstacles	daytime	ancestors
ways	trades	habits	selection	economy

Bats have a problem: how to find their way around in the dark. They hunt at night, and cannot use light to help them find prey and avoid **1**……. . You might say that this is a problem of their own making, one that they could avoid simply by changing their **2**…….and hunting by day. But the day time **3**……. is already heavily exploited by other creatures such as birds. Given that there is a living to be made at night, and given that alternative **4**……. trades are thoroughly occupied, natural **5**……. has favoured bats that make a go of the night-hunting trade. It is probable that the nocturnal **6**…… go way back in the ancestry of all mammals. In the time when the 7……. dominated the daytime economy, our mammalian ancestors probably only managed to survive at all because they found **8**……. of scraping a living at night. Only after the mysterious mass **9**……. of the dinosaurs about 65 million years ago were our **10**……. able to emerge into the daylight in any substantial numbers.

QUESTION- III

Fill in the gaps with the correct form of verbs in brackets.

1. Be quiet! I ……. (want) to hear the news.
2. In my country we ……. (drive) on the right-hand side of the road.
3. My friend Joe's parents ……. (travel) round the world this summer, and probably won't be back for a couple of months.
4. The college ……. (run) the same course every year.

5. Numbers of wild butterflies ..... (fall) as a result of changes in farming methods.
6. I'm busy right now. I ..... (fill in) an application form for a new job.
7. My tutor ..... (see) me for a tutorial every Monday at two o'clock.
8. John ..... (not/study) very hard at the moment. I don't think he'll pass his exams.
9. 'What is he doing?' 'He ..... (try) to fix the television aerial.'
10. Animals ..... (breathe in) oxygen and give out carbon dioxide.

QUESTION- IV

(A) Describe an idea you had for improving something at work or college.

You should say:

- when and where you had your idea
- what your idea was
- who you told about your idea

and explain why you thought your idea would make an improvement.

(B) Answer the following questions.

1. How do you usually contact your friends? (Why?)
2. Do you prefer to contact different people in different ways? (Why?)
3. Do you find it easy to keep in contact with friends and family? (Why/Why not?)
4. In your country, did people in the past keep in contact in the same ways as they do today? (Why/Why not?)
5. Do you think face to face communication is important in your society? (Why/Why not?)

QUESTION- V

*Write an **Essay** on the following topic:*

"Some items (such as clothes or furniture) can be made by hand or by machine. Which do you prefer – items made by hand or items made by machine? Use reasons and specific examples to explain your choice."

THE END

Department of Advanced Science and Technology
University of Computer Studies
B.C.Sc. (Honours)
Mid Term Examination
Operations Research (CS-401)
28-3- 2014
Zone IV

Answer All Questions **Time allowed: 3 hours.**

1(a).A tape recorder company manufactures models A, B and C which have profit contributions per unit of Rs 15, Rs 40 and Rs 60 respectively. The weekly minimum production requirements are 25 units for model A, 130 units for model B, and 55 units for model C. Each type of recorder requires a certain amount of time for the manufacturing of component parts, for assembling and for packing. Specifically, a dozen units of model A require 4 hours for manufacturing, 3 hours for assembling and 1 hour for packaging. The corresponding figures for a dozen units of model B are 2.5, 4 and 2 and for a dozen units model C are 6,9 and 4. During the forthcoming week, the company has available 130 hours of manufacturing, 170 hours of assembling and 52 hours of packaging time. Formulate this problem of production scheduling as LP model so as to maximize profit.

(b). Use the graphical method to solve the following LP problem.

(i) Maximize $Z = 2x_1+x_2$
s.t
$x_1+2x_2 \leq 10$
$x_1+ x_2 \leq 6$
$x_1- x_2 \leq 2$
$x_1 -2x_2 \leq 1$
and $x_1, x_2 \geq 0$

(ii) Maximize $Z = 80x_1+120x_2$
s.t
$x_1+ x_2 \leq 9$
$x_1+ x_2 \geq 5$
$2x_1+ 5x_2 \leq 36$
$x_1 \geq 2; x_2 \geq 3$
and $x_1, x_2 \geq 0$

2(a). Solve the following LP problem by **two-phase** method.
Maximize $Z = 3x_1-x_2$
s.t
$2x_1+ x_2 \geq 2$
$x_1+3x_2 \leq 2$
$x_2 \leq 4$
and $x_1, x_2 \geq 0$

(b). Use penalty **(Big-M)** to solve the following LP problem.
Minimize $Z = 5x_1+3x_2$
s.t
$2x_1+ 4x_2 \leq 12$
$2x_1+ 2x_2 = 10$
$5x_1+ 2x_2 \geq 10$
and $x_1, x_2 \geq 0$

3(a). Write the dual of the following LP problem.

(i)Minimize $Z_x = 3x_1-2x_2+4x_3$

s.t

$3x_1+5x_2+4x_3 \geq 7$

$6x_1+ x_2 +3x_3 \geq 4$

$7x_1- 2x_2- x_3 \leq 10$

$x_1-2x_2 -5x_3 = 3$

$4x_1+7x_2-2x_3 \geq 2$

and $x_1, x_3 \geq 0$, x_2 is unrestricted in sign.

(ii) Maximize $Z_x = 3x_1+x_2+2x_3-x_4$

s.t

$2x_1-x_2+3x_3+x_4=1$

$x_1+ x_2 - x_3+x_4 =3$

and $x_1, x_2 \geq 0$, x_3, x_4 unrestricted in sign.

(b). Obtain an optimal solution, if any, to the following primal LP problem and deduce from it the solution to the dual LP problem.

Maximize $Z = x_1+6x_2$

s.t

$x_1+x_2 \geq 2$

$x_1+3x_2 \leq 3$

and $x_1, x_2 \geq 0$

4(a). Use the dual simplex method to solve the problem.

Minimize $Z = 3x_1+x_2$

s.t

$x_1+ x_2 \geq 1$

$2x_1+3x_2 \geq 2$

and $x_1, x_2 \geq 0$

(b). Give the LP problem

Maximize $Z = -x_1+2x_2-x_3$

s.t

$3x_1+ x_2- x_3 \leq 10$

$-x_1+4x_2 +x_3 \geq 6$

$x_2+x_3 \leq 4$

and $x_1, x_2, x_3 \geq 0$

Determine the ranges for discrete changes in the components b_1 and b_2 of the LP model so asto maintain optimality of the current solution.

Department of Advanced Science and Technology
University of Computer Studies
B.C.Sc/B.C.Tech(Honours)
Mid Term Examination
Mathematics of Computing IV (CST-402)
31-3-2014
Zone IV

Answer ALL Questions. **Time Allowed: 3 hours.**

1. (a) Solve the following linear system by Cramer's Rule.

$$9x + 6y + 12z = 17.4$$
$$6x + 13y + 11z = 23.6$$
$$12x + 11y + 26z = 30.8$$

(b) Calculate the inverse of the matrix $A=\begin{bmatrix} 4 & -2 & -1 \\ 3 & -2 & 0 \\ -12 & 7 & 2 \end{bmatrix}$ by Gauss-Jordan elimination or state that it does not exist.

2. (a) Find the principal directions and corresponding factors of extension or contraction of the elastic deformation y=Ax with given $A=\begin{bmatrix} 2 & 3.5 \\ 2 & 8 \end{bmatrix}$.

(b) Is the matrix $A=\begin{bmatrix} 6i & 4+2i \\ -4+2i & -2i \end{bmatrix}$ Hermitian, skew-Hermition or unitary? Find the spectrum and eigenvectors of A.

3. Daigonalize the matrix $A=\begin{bmatrix} 2 & 1 & -4 \\ 1 & -1 & -2 \\ 1 & 2 & -2 \end{bmatrix}$ by $D = X^{-1}AX$. What happens to D if you interchange the columns of X (Doesn't need detail calculation)?

4. (a) Find out what type of conic section (or pair of straight lines) is represented by the quadratic form, $7.4\,x_1^2 + 6.4x_1x_2 + 2.6\,x_2^2 = 9$. Transform it to principal axes. Express $x^T=[x_1\ x_2]$ in terms of the new coordinate vector $y^T=[y_1\ y_2]$.

(b) Are the following sequences $z_1, z_2, z_3, \ldots$ bounded? Convergent? Find their limit points.

(i) $z_n = n^2 + \frac{i}{n^2}$ (ii) $z_n = \frac{(1+i)^{2n}}{2^n}$

5. (a) Are the following series convergent or divergent?

(i) $\sum_{n=0}^{\infty}(1+2i)^n$ (ii) $\sum_{n=0}^{\infty} n^2(\frac{i}{5})^n$

(b) Find the center and the radius of convergence of the following power series.

(i) $\sum_{n=0}^{\infty}\frac{(-1)^n n}{8^n}z^n$ (ii) $\sum_{n=0}^{\infty} 4^n(z+1)^n$

Department of Advanced Science and Technology
University of Computer Studies
Analysis of Algorithms (CS-403)
B.C.Sc.(Hons) First Term Examination
March 2014
Zone IV

Answer **all** questions — Time allowed 3 hours

1. (a) Define the **four** of the following : **(8 marks)**
   - (i) Logarithmic space complexity
   - (ii) Ordered Tree
   - (iii) Queue
   - (iv) Asymptotic time complexity
   - (v) Depth of a vertex

   (b) Briefly explain **three** of the following: **(12 marks)**
   - (i) *Divide-and-conquer Approach*
   - (ii) List & Bit vector representation of set
   - (iii) Random Access Stored Program Model (RASP)
   - (iv) Worst-case time complexity & Expected time complexity

2. (a) Give Pidgin ALGOL and RAM program to find the remainder (x mod y) of two numbers x and y. **(10 marks)**

   (b) Prove that if costs of instructions are either uniform or logarithmic, for every RAM program of time complexity T(n) there is a constant k, such that there is an equivalent RASP program of time complexity kT(n). **(10 marks)**

3. (a) By using decision tree, sort a sequence A = {a, b, c} into non-decreasing order. **(8 marks)**

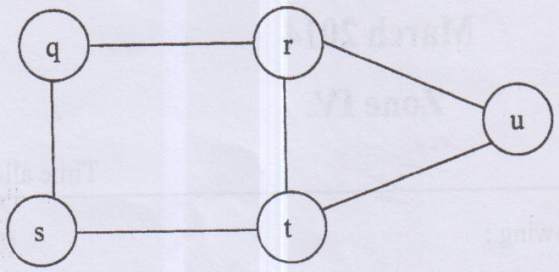
   (b) Specify a Turing Machine which prints 0^{n^3} on tape 2 when started with 0^n on tape 1. Analyze the time and space complexity of that problem. **(12 marks)**

4. (a) Find the followings from the given graph below:

(i) Adjacency matrix

(ii) Adjacency list

(iii) Tabular representation



(10 marks)

(b) Find the minimal number of operations in multiplying the following matrices using the dynamic programming algorithm below:

M = M1	*	M2	*	M3	*	M4
[20 x 50]		[50 x 1]		[1 x 100]		[100 x 20]

Also find the order of execution to multiply. **(10 marks)**

```
begin
    1.  for i=1 until n do  m_ii = 0;
    2.  for l=1 until n-1 do
        begin
    3.    for i = 1 until n-l do
          begin
    4.      j = i + l;
    5.      m_ij = MIN_{i<=k<=j} (m_ik + m_{k+1,j} + r_{i-1} * r_k * r_j );
          end;
    6.    write m_ij;
        end;
end
```

5. (a) Use the lexicographic sort algorithm to sort the strings *abc, bca, bbc, acc, bac, dad, bad, bed, aac, bdc, abb*. **(10 marks)**

(b) Proof that the worst-case running time of Selecting k^{th} smallest element is O(n). **(10 marks)**

Department of Advanced Science and Technology
University of Computer Studies
B.C.Sc (Hons:)
First Term Test
CS- 404 (Database Management System)
March, 2014
Zone IV

Answer all questions. **Time allowed: 3:00 hours.**

1. Write a short note on **Any FIVE** of the following: (5 marks each)

(a) Trigger Procedures
(b) Audit Trails
(c) Data Access Middleware
(d) Location Independence
(e) Common design practices in decision support environment
(f) Operation data store (ODS)
(g) Scalar operators on intervals

2. Consider the following relational schema

S(S#, SNAME, STATUS, CITY)

P(P#, PNAME, COLOR, WEIGHT, CITY)

J(J#, JNAME, CITY)

SPJ(S#, P#, J#, QTY)

(a) Write the following integrity constraints by using appropriate language. (12 marks)

(i) No shipment can have a quantity more than double the average of all such quantities.
(ii) Every London supplier must supply part P2.
(iii)Suppliers in London must supply more different kinds of parts than suppliers in Paris.
(iv)The average supplier status must be greater than 28.
(v) The only legal cities are London, Paris, Athens, Oslo, Stockholm, Madrid.

(b) For each of your answers to above question 2(a), state whether the constraints is a type constraint or relvar constraint or database constraint. (4 marks)

(c) Write the following security constraints by using appropriate language. (9 marks)

(i) User Amy can see the supplier numbers and status for supplier in Paris with status>20.
(ii) User Chuck can update the color of parts supplied by supplier S1.
(iii)User Fidel can see total shipment quantities per supplier, but not individual shipment quantities.

3. Why data encryption is needed? Describe the details of the encryption algorithm with the following:

Plaintext : I AM A STUDENT

Encryption key: CASTY (9 marks)

4(a) Discuss the Catalog Management of the distributed database systems. (7 marks)

4(b) Consider the following supplier-part database:

S (S#, CITY)	10,000	stored tuples at London site
P (P#, COLOR)	100,000	stored tuples at Paris site
SP (S#, P#)	1,000,000	stored tuples at London site

Assume that every stored tuple is 25 byte (200 bits) long.

Estimated cardinalities of certain intermediate result:

Number of red parts = 10

Number of shipments by London supplier = 100,000

Communication Assumption:

Data rate = 50,000 bits per second

Access delay = 0.2 second

Describe the possible distributed query processing strategies and examine which is the best strategy for the query "Get supplier numbers for London suppliers who supply at least one red part". (10 marks)

5(a) Discuss the online analytical processing queries using ROLL UP and CUBE operations. (8 marks)

5(b) What are the differences between replication and copy management. (5 marks)

6(a) What is the decision support system? (5 marks)

6(b) Consider the following schema:

S_SINCE (S#, SNAME, STATUS, CITY, SINCE)

SP_SINCE (S#, P#, SINCE)

Write the following queries in relational algelbra or relational calculus. (6 marks)

(i) Get suppliers numbers of suppliers who are currently able to supply some part, showing in each case the date since when they have been able to do so.

(ii) Get S# - SINCE pairs for suppliers who have been able to supply any parts at all at some time, where SINCE designates a maximal continuous period during which supplier s# was in fact table to supply some part.

Department of Advanced Science and Technology
University of Computer Studies
B.C.Sc. (Honours)
Mid-term Examination
CS-405 (Software Engineering)
April, 2014

Answer all questions. **Zone IV** **Time allowed : 3 hours**

I.(a) Discuss about the verification and validation planning. Suggest a structure of a test plan used in verification and validation process. (10 marks)

(b) Testing methods are used to test programs to discover program faults. Briefly discuss White box testing.

(or)

Briefly explain about top-down and bottom- up testing strategies. (10 marks)

II. (a) Briefly describe the different strategies for software change. (10 Marks)

(b) Briefly discuss about the reverse engineering which is the process of deriving a system design and specification from its source code. (10 Marks)

III. (a) Statistical testing is used to estimate software reliability. Discuss about the reliability measurement problems. (10 Marks)

(b) Explain the difference types of process and product that might be used in the process improvement.

(or)

State data re-engineering. Give the reasons for data reengineering. (10 Marks)

IV. (a) Mention the stages of static analysis process. (10 Marks)

(b)Software maintenance is the general process of changing a system after it has been delivered. Discuss different types of software maintenance.

(or)

Software process is complex and involves a very large number of activities. Explain the process characteristics. (10 Marks)

V. (a) Testing is an expensive and laborious phase of the software process. Explain about the testing workbenches. (10 Marks)

(b) Briefly explain about the SEI process maturity model. (10 Marks)

Department of Advanced Science and Technology

University of Computer Studies

Artificial Intelligence (CS-406)

B.C.Sc.(Hons) First Term Examination

March 2014

Zone IV

Answer **all** questions — Time allowed 3 hours

1. Define the followings:**(20 marks)**
   - (i) Truth Table
   - (ii) Backward Chaining
   - (iii) Inference
   - (iv) Unit Propagation
   - (v) Ground term
   - (iv) Unification

2. (a) Determine whether the following sentence is valid, satisfiable or unsatisfiable by using a truth table.

$$((P \vee Q) \Rightarrow \neg R) \wedge (\neg R \vee (Q \vee P))$$

   (b) Consider a knowledge base containing just two sentences: P(a) and P(b). Does this knowledge base entail $\forall x P(x)$? Explain your answer in terms of models.

   (c) What are the disadvantages of Forward Chaining?

   (d) Describe the basic syntactic elements of first-order logic with examples? **(20 marks)**

3. (a) Discuss three improvements of A Complete Backtracking algorithm over the simple scheme of TT-ENTAILS?

   (b) Discuss Theorem provers in detail. **(20 marks)**

4. (a) Decide if the following is true or false?

   (i) $(A \Leftrightarrow B) \Leftrightarrow C$ has the same number of models as $A \Leftrightarrow B$ for any fixed set of proposition symbols that include A,B,C.

   (ii) Which of the following is a declarative statement?
      - (a) It is beautiful.
      - (b) He says "It is correct".
      - (c) Two may not be an even integer.
      - (d) I love you.

   (iii) Which of the follows are tautology?

(a) $(p \vee q) \Rightarrow p$

(b) $p \vee (q \Rightarrow p)$

(c) $p \vee (p \Rightarrow q)$

(d) $p \Rightarrow (p \Rightarrow q)$

(b) Represent the following sentences in first-order logic.

(i) Thida is elder than Thura.

(ii) Whoever can read is literate.

(iii) All numbers are bigger than themselves divided by two.

(iv) Calculators contain at least one battery.

(v) Adjoining an element already in the set has no effect. **(20 marks)**

5. (a) Someone says: "One either Saturday or Sunday, if I am free, I will go to the concert". Using propositional logic, the statement is represented as:

$$(\text{Saturday} \wedge \text{Sunday}) \Rightarrow (\text{Free} \Rightarrow \text{concert})$$

Convert the above sentence into conjunctive normal form.

(b) Attempt to unify the following pairs of expression. Either shows their most general unifier or explain why they will not unify.

(i) parents(x, father(x), mother(Bill)) , parents(Bill, father(Bill), y)

(ii) f(a) , g(a)

(iii) F(a,x), F(a,b)

(c) Suppose the agent has progressed to the point shown in the following figure, having perceived nothing in [1,1] and a breeze in [2,1], and is now concerned with the contents of [1,2], [2,2] and [3,1]. Each of these can contain a pit. Construct the set of possible worlds.(you should find 8 of them) Mark the worlds in which the KB is true and those in which each of the following sentences is true:

$\alpha 1$=There is no pit in [1,2].

$\alpha 2$=There is no pit in [2,2].

? [1,2]	? [2,2]		
[1,1]	Breeze [2,1]	? [3,1]	

Show that KB $\models \alpha 1$ and KB $\models \alpha 2$. **(20 marks)**

Department of Advanced Science and Technology
University of Computer Studies
Artificial Intelligence (CT-401)
B.C.Tech.(Hons) First Term Examination
March 2014
Zone IV

Answer **all** questions — Time allowed 3 hours

1. Define the followings: **(20 marks)**
   - (i) Logical Equivalence
   - (ii) Satisfiability
   - (iii) Definite Clause
   - (iv) Arity
   - (v) Unification

2. (a) Write example of atomic stentence and complex sentence. **(20 marks)**
   (b) Show the $P \Rightarrow (P \wedge (Q \Rightarrow P))$ is a tautology.
   (c) Determine whether the following sentence is valid, satisfiable or unsatisfiable by using a truth table.
   $(Smoke \Rightarrow Fire) \Rightarrow (\neg Smoke \Rightarrow \neg Fire)$
   (d) Describe ontological and epistemological commitments of five different logics.

3. (a) Discuss three improvements of A Complete Backtracking algorithm over the simple scheme of TT-ENTAILS?
   (b) Explain about the Resolution strategies in details. **(20 marks)**

4. (a) Draw the corresponding AND-OR graph for the following knowledge base of Horn clauses.
   $P \Rightarrow Q$
   $L \wedge M \Rightarrow P$
   $B \wedge L \Rightarrow M$
   $A \wedge P \Rightarrow L$
   $A \wedge B \Rightarrow L$
   A
   B
   (b) In the sentences below a symbol is missing. What symbol is mostly like to be?
   (i) $\forall x$ Something(x) _____ somethingelse(x).

(ii) $\exists x$ Something(x) _____ somethingelse(x).

(iii) Peter has at least two children. Is the following correctly written? If not correct the answer.

$\exists x,y$ ParentOf(Peter, x) $\wedge$ ParentOf(Peter, y)

(c) Represent the following sentences in first-order logic.

(i) There are some people who love nobody but themselves.

(ii) All computers are PCs.

(iii) Every student who takes French passes it.

(iv) Only those trees that are tall have long roots.

(v) Adding "0" to any natural number ***m*** gives ***m*** itself.

(20 marks)

5. (a) Suppose the agent has progressed to the point shown in the following figure, having perceived nothing in [1,1] and a breeze in [2,1], and is now concerned with the contents of [1,2], [2,2] and [3,1]. Each of these can contain a pit. (you should find 8 of them) Construct the set of possible worlds. Mark the worlds in which the KB is true and those in which each of the following sentences is true:

$\alpha 1$=There is no pit in [1,2].

$\alpha 2$=There is no pit in [2,2].

? [1,2]	? [2,2]		
[1,1]	Breeze [2,1]	? [3,1]	

Show that KB |= $\alpha 1$ and KB |= $\alpha 2$.

(b) Consider the following sentences.

Anyone passing his history exams and winning the lottery is happy.

But anyone who studies or is lucky can pass all his exams.

John did not study but is lucky.

Anyone who is lucky wins the lottery.

Is John happy?

(i) Convert each of the four axioms to CNF form.

(ii) Prove John is happy using resolution. **(20 marks)**

Department of Advanced Science & Technology
University of Computer Studies
B.C.Tech. (Honours)
Mid-term Examination
Computer Architecture (CT 404)
April 2014
Zone IV

Answer *all* questions. **Time allowed: 3 hours**

1. (a) Consider the design of a circuit to add two 4-bit unsigned binary numbers. Obtain the expressions for sum and carry-out of 1-bit full-adder and based on this full-adder implement the 4-bit adder in (i) serial and (ii) ripple parallel fashions. (iii) Determine the number of clock cycles for addition of two 4-bit numbers in these fashions. (12 marks)

   (b) Illustrate how 8-bit twos-complement adder-subtracter can be composed of 4-bit adders to perform operations: $X + Y$, $X - Y$ and $Y - X$. (4 marks)

2. (a) Twos-complement negation for an integer $X = x_{n-1}x_{n-2}x_{n-3} \ldots x_1x_0$ is specified by $-X = \bar{x}_{n-1}\bar{x}_{n-2}\bar{x}_{n-3} \cdots \bar{x}_1\bar{x}_0 + 000 \cdots 01$ (modulo 2^n). Derive a single formula which is valid for both positive and negative n-bit integers. (8 marks)

   (b) Suppose that the divisor V and dividend D are unsigned integers and the quotient $Q = q_{n-1}q_{n-2}q_{n-3} \ldots$ is to be computed one bit at a time. To perform this either restoring or non-restoring division technique can be used by addition and/or subtraction steps. Compare the required number of additions and/or subtractions for these division techniques. (8 marks)

3. (a) An ALU has separate subunits for logical and arithmetic operations, Draw a possible structure of this ALU whose maximum number of distinct logical operations is 16 and that of distinct arithmetic operations is 16. Express how logical operations of this can be obtained with an appropriate example. (8 marks)

   (b) An algorithm for floating-point addition is given in Figure 1. Using this algorithm, illustrate the addition of two 32-bit floating-point numbers (X = 0 01111111 10000000000000000000000 and Y = 0 10000111 00101011010000000000000) in IEEE Standard format whose value N is given by $N = (-1)^S 2^{E-127}(1.M)$. (8 marks)

```
                register AC[n_M-1:0], DR[n_M-1:0], E[n_E-1:0], E1[n_E-1:0], E2[n_E-1:0],
                AC_OVERFLOW, ERROR;
BEGIN:          AC_OVERFLOW: = 0, ERROR: = 0;
LOAD:           E1: = X_E, AC: = X_M; E2: = Y_E, DR: = Y_M;
COMPARE:        E: = E1 – E2;
EQUALIZE:       if E < 0 then AC: = right-shift(AC), E: = E + 1, go to EQUALIZE; else
                if E > 0 then DR: = right-shift(DR), E: = E - 1, go to EQUALIZE;
ADD:            AC: = AC + DR, E: = max(E1, E2);
OVERFLOW:       if AC_OVERFLOW = 1 then
                begin
                  if E = E_MAX then go to ERROR;
                    AC : = right-shift(AC), E: = E + 1, go to END;
                end
ZERO:           if AC  = 0 then E: = 0, go to END;
NORMALIZE:      if AC  is normalized then go to END;
UNDERFLOW:      if E > E_MIN then AC: = left-shift(AC),  E: = E - 1, go to EQUALIZE;
ERROR:          ERROR: = 1;
END:
```

Figure 1. The algorithm for floating-point addition

4. (a) Consider a particular function or set of functions F to be performed. Analyze whether or not they can be implemented by a pipelined or nonpipelined processor. (8 marks)

(b) Illustrate how multiplication can be performed using a multistage carry-save adders for multiplying two n-bit fixed point binary numbers $X = x_{n-1}x_{n-2} \ldots x_1x_0$ and $Y = y_{n-1}y_{n-2} \ldots y_1y_0$ for n=3. Show how carry-save multiplication is well suited to pipelined implementation. (8 marks)

5. (a) (i) Describe the trade-offs that involves in designing control-units. (ii) On which views, hardwire controllers are designed? (iii) In designing hardwired controllers, describe how classical and one-hot approaches have been realized. (10 marks)

(b) Procedure to compute the greatest common divisor (*gcd*) of two numbers is given in Figure 2. Identifying the states needed, construct a state table for control unit of this *gcd* processor. (8 marks)

```
gcd (in:X,Y; out:Z);
      register XR, YR, TEMPR;
      XR:=X;   (Input the data)
      YR:=Y;
      while XR>0 do begin
         if XR≤YR then begin        (Swap XR and YR)
               TEMPR:=YR;
               YR:=XR;
               XR:=TEMPR; end
               XR:=XR-YR;      (Subtract YR from XR)
      end
      Z:=YR;  (Output the result)
end gcd;
```

Figure 2. HDL Description of gcd procedure

6. A Mealy-type state transition graph for the state behavior of accumulator-based CPU is described in Figure 3. To implement this finite state machine using D flip-flops with the output D_i of the i^{th} flip-flop forming the hot variable for state S_i or S_i^*. (i) Examine the completion states of each instruction (opcode). (ii) How many D flip-flops are needed to implement this FSM in one-hot design? (iii) Write down a set of logic equations that define FSM directly from this figure. (iv) Express the output equations of this FSM. (18 marks)

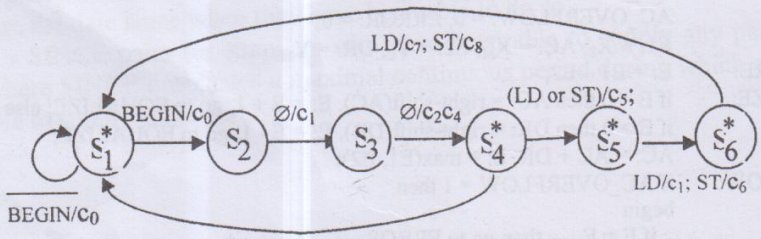


Figure 3. State transition graph for the accumulator-based CPU

Department of Advanced Science and Technology
University of Computer Studies
B.C.Tech. (Honours)
Mid-Term Examination
Linear Control System II (CT-405)
March, 2014
Zone IV

Answer all questions. **Time allowed: 3 hours**

1(a) Consider a feedback control system with

$$G(s) = \frac{K(S+1)}{s^2+4S+5} \quad \text{and} \quad H(s) = \frac{1}{(s+3)}$$

Sketch the **Root Locus** of the system as K increases.

1(b) A unity feedback system has a process

$$KG(s) = \frac{4(S+z)}{S(S+1)(S+3)}$$

(i) Draw the root locus as z varies from 0 to 100.
(ii) Using the root locus, estimate the percent overshoot and settling time (2% criterion) of the system at z= 2 for a step input.
(iii) Determine the actual overshoot and settling time at z= 2.

2. The United States is planning to have an operating space station in orbit by 2004. It is critical to keep this station in the proper orientation toward the sun and the earth for generating power and communications. The orientation controller may be represented by the unity feedback system with an actuator and controller:

$$G(s) = \frac{K(s+20)}{s(s^2+24s+100)}.$$

(i) Sketch the **Root Locus** of the system as K increases.

(ii) Find the value of K that result in an oscillation response.

3. A robot arm has a joint-control open-loop transfer function

$$G(S) = \frac{300(S+100)}{S(S+10)(S+40)}$$

Determine the corner frequencies for the Bode plot. Sketch the asymptotic logarithmic magnitude versus phase angle curves for this robot arm system. Find the gain and phase margins of this system.

4. Consider the unity feedback system with

$$G(s) = \frac{K}{s(s+1)(s+2)}$$

For K=4, Find the gain and phase margins of this system using exact method.

5. A feedback control system has a loop transfer function: $GH(s) = \dfrac{K}{s(s+2)}$. It is desired to have a steady-state error for a ramp input equal to 5 % of the magnitude of the ramp. Furthermore we desire that the phase margin of the system be at least 45°. Design a phase-lag compensator on the Bode diagram.

6. The single-loop feedback control system is shown in Figure 6. The **lead compensation** network is added to get the following specifications:

   (i) Settling time ≤ 4 sec

   (ii) Percent overshoot for a step input ≤ 35%

   (iii) Find the lead compensator using the Root Locus.

   (iv) Obtain the sensitivity at a dominant root r, $\left|S_K^r\right|$.

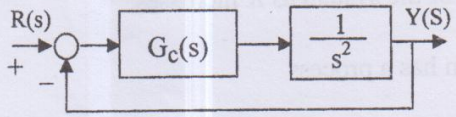


Figure 6

* * * * * * * * * * * * * * *

Department of Advanced Science and Technology
University of Computer Studies
B.C.Tech. (Honours)
First Semester Examination (March, 2014)
Computer Networking (CT- 406)

Answer ALL Questions **Zone IV** **Time allowed: 3 hours**

1. Define the following terms: **(2 marks each)**
   (a) Gigabit Ethernet
   (b) ICMP
   (c) AS
   (d) Inelastic Traffic
   (e) ATM
   (f) Virtual Lane
   (g) Anycast
   (h) Mobile IP
   (i) Marker
   (j) ARP

2. Answer ***ANY SIX*** of the followings: **(4 marks each)**
   (a) Binary exponential backoff
   (b) IPv6 enhancements over IPv4
   (c) Three main functions of BGP
   (d) Two principal characteristics of RSVP
   (e) Multiple Access Protocols
   (f) Multilane distribution
   (g) The pros and cons of limiting reassembly to the endpoint as compared to allowing en route reassembly
   (h) Inefficiency of the broadcast and multiple unicast strategies
   (i) DS Traffic Conditioner
   (j) Properties of Link-Layer Switching

3. (a) Write CSMA/CD rules and explain the operation of CSMA/CD with figure.
   (b) Define IPv6 Structure. What is the difference between the traffic class and flow label fields in the IPv6 header?

4. (a) What operations are performed by IGMP? Give a brief description of IGMP message format.
   (b) Describe the original requirements for the design of Point-to-Point Protocol (PPP).

5. (a) Explain the rules in the flow label.
   (b) Describe the differences between Switches and Routers.

6. What is the purpose of Integrated Service Architecture? List and briefly describe the three categories of service offered by ISA.

(OR)

6. Contrast and compare distance vector routing with link state routing. Give a brief description of the Open Shortest Path First (OSPF) Protocol. What algorithm does OSPF routing use to calculate the routing tables?

(14 marks each)