



Course Title: Software Engineering  
Date: June 7<sup>th</sup> 2014 (Second term)

Course Code:: CCE3218  
Allowed time: 3 hrs

Year:3<sup>rd</sup>  
No. of Pages: (2)

**Remarks: Please Read the question more than once to fully understand it before you start solving, Do not forget to make verification and validation for your answers.**

**Problem number (1) (20 Marks)**

(a) **Define the role of each of the following staff:**

1- SW maintenance engineer      2- Analyst      3- Programmer

Also state from where each of them starts to work and to where each sends his work.

(b) If one of the resources needed for the project are subjected to be delayed (معرضة للتأخير) as they will be brought from outside the country, how will you deal with such problem? Give two possible solutions.

(c) Which SDLC model will you use when the users of the SW being developed are hesitating (مترددین) and do not know what to require in the SW and some of them have contradicting (آراء متعارضة) opinions. Draw the model diagram steps and describe how to perform these steps.

**Problem number (2) (20 Marks)**

(a) In a SW designed for faculty library (مكتبة الكلية) there are many tasks required.

i- What are the users of this system?

ii- For each user suggest 4 functions. Describe these functions in details and draw the conceptual model for them.

iii- Draw a draft for DFD context diagram and level 0.

iv- What is the database needed for such system. Give some details for this database schema.

(b) Compare between the following pairs:

1- Incremental and spiral SDLC.

2- Static and dynamic test techniques.

**Problem number (3) (20 Marks)**

(a) What is the origin of the following SW, and make a small note on each:

1- Web Camera driver

2- RealPlayer SW

3- Sony company Web page

(b) Fill in the spaces for each statement. Write down the whole statement into your papers:

1- Pert chart shows -----

(draw an example for it too)

2- Political feasibility is interested in determining ----- according to -----.

3- You have to prepare a plane for an interview with the user that contains: -----

**Problem number (4) (30 Marks)**

(a) In the following DFD, answer the following questions:

1- What is this level?

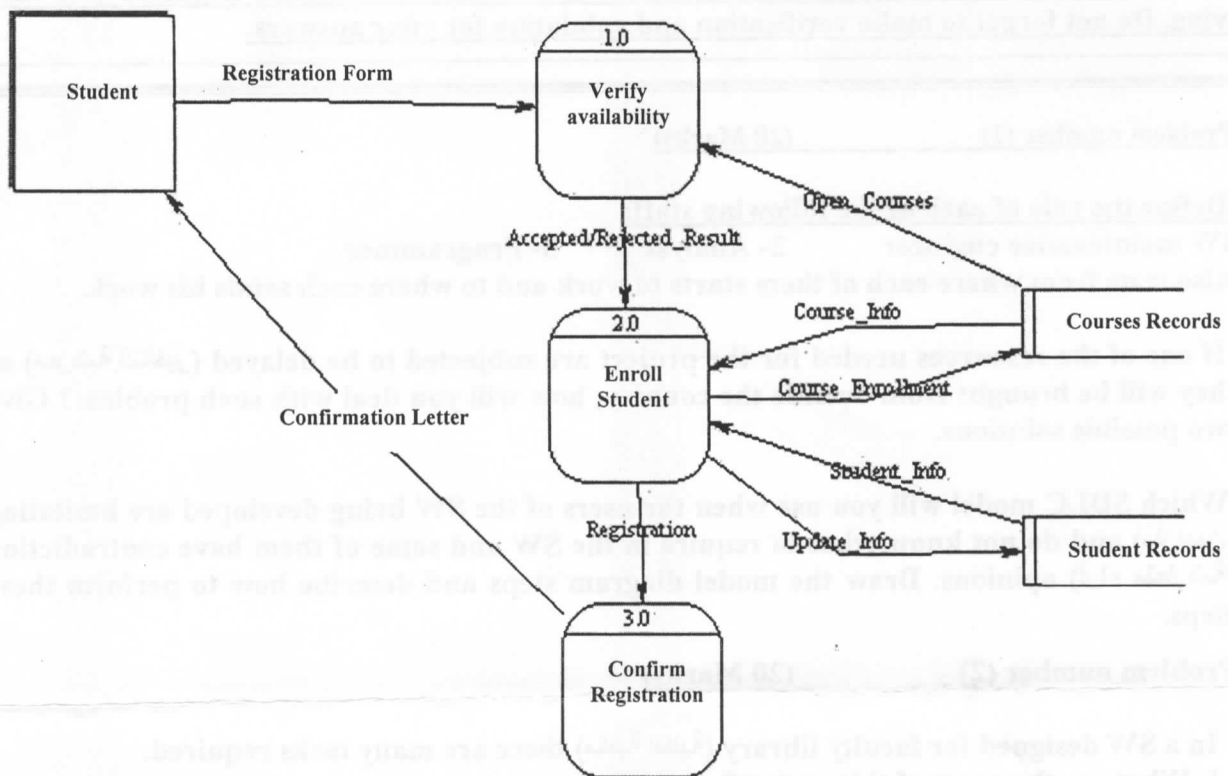
2- How many tasks are there in the diagram? And what are there names?

3- What are the datastores available here?

4- What are the sources/sinks in the diagram?

5- Draw a context diagram for this system and balance it with this level.

6- For the tasks: 3.1.2 and 2.1.2.4 : what is the level they are in, what task they belong to and what is the minimum subtasks found in this level.



- (b) How to verify a software package you are buying before you buy it?
- (c) How to be a good programmer?
- (d) What is meant by adequacy test criteria? How to avoid corrective maintenance?

Good Luck all

Course Coordinator: Assoc. Prof. Dr. Amany Sarhan

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Course Title: **Digital Control**  
Date: June 11<sup>th</sup>, 2014

Course Code: CCE3220  
Allowed time: 3 Hours

Year: 3<sup>rd</sup> Comp.  
No. of Pages: 2

**Remarks:** You must show all of your work -- partial credit may be given to partially correct answers, while answers with no justification may not receive full points. Please attempt all questions.

**Problem (1) (30 Marks)**

a- A function  $e(t) = A \cos(\omega t)$  is sampled every  $T=0.2$  sec. If the z-transform of the resultant sequence is given by:

$$E(z) = \frac{3z(z - 0.6967)}{z^2 - 1.3934z + 1}$$

Solve for  $A$  and  $\omega$ ? (7 Marks)

b- Given:

$$y(k+2) - \frac{3}{4}y(k+1) + \frac{1}{8}y(k) = e(k)$$

where,  $e(k) = 1, k = 0, 1, 2, 3, \dots$   
and  $y(0) = y(1) = 0$

- i. Find the sequence of  $y(k)$  up to  $y(5)$  by solving the difference equation directly (i.e. sequentially). (5 Marks)
- ii. Solve for  $y(k)$  using Z-transformation and find the steady-state value of  $y(k)$  as  $k$  approaches infinity. (8 Marks)

c- For the block diagram given in Fig.1, find, if it exists, the closed loop transfer function.

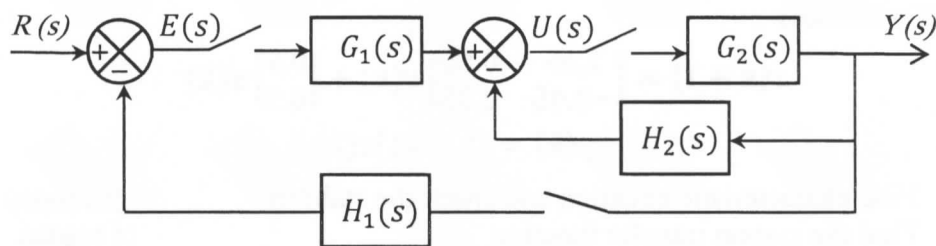


Fig. 1: Block diagram of problem 1-c

**Problem (2) (35 Marks)**

- a. For the unity feedback control system shown in Fig. 2, find
  - i. The closed loop pulse transfer function and check the stability. (6Marks)
  - ii. The final value of the output for unit step input. (2Marks)
  - iii. The first four terms of the output sequence ( $y(0), y(1), y(2),$  and  $y(3)$ ) for a unit step input. (4Marks)

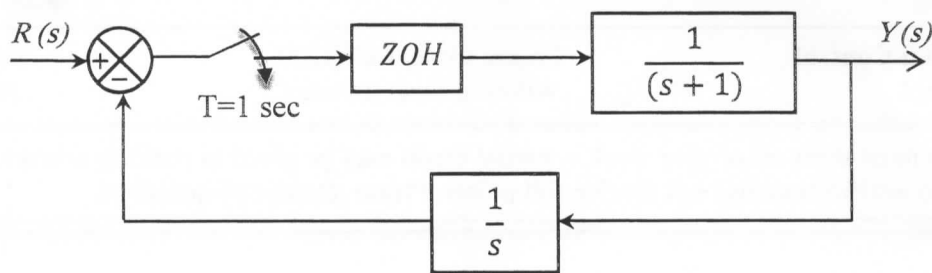


Fig. 2: Block diagram of problem 2-a

- b. For the unity feedback control system shown in Fig. 3,
- Find using root locus technique the stable range of K. (12 Marks)
  - Find the steady state error for a unit ramp input when  $K=(K_{\text{critical stability}}/2)$ . (3Marks)

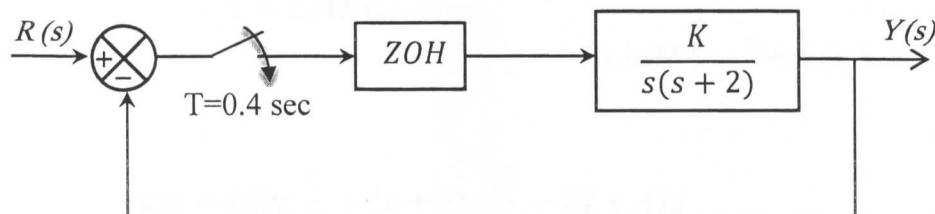


Fig. 3: Block diagram of problem 2-b

- c. Check using Jury test the stability of the control systems having the characteristic equation:- (8 Marks)

$$Z^3 - 0.5 Z^2 + 2.49 Z - 0.496 = 0$$

**Problem (3) (25 Marks)**

- a- Consider the discrete-time state space of a conveyer system when sampled at a rate 10HZ (i.e.  $T = 0.1$  sec)

$$x(k+1) = \begin{bmatrix} 1.35 & 0.55 \\ -0.45 & 0.35 \end{bmatrix} x(k) + \begin{bmatrix} 0.5 \\ 0.5 \end{bmatrix} u(k)$$

$$y(k) = [1 \quad -1]x(k)$$

- Find characteristic equation and check the stability (5 Marks)
  - Find the system transfer function (4 Marks)
  - Check the system complete state controllability (3 Marks)
  - Check the system complete state observability (3 Marks)
- b- Consider the electrical system given by the following state equations. (10 Marks)

$$x(k+1) = \begin{bmatrix} 1 & 0.0952 \\ 0 & 0.905 \end{bmatrix} x(k) + \begin{bmatrix} 0.00484 \\ 0.0952 \end{bmatrix} u(k)$$

$$y(k) = [1 \quad 0]x(k)$$

Determine the gain matrix K of the state feedback controller when the desired characteristic equation is required to be:

$$\alpha_c(z) = z^2 - 1.776 z + 0.819$$

**Good Luck**



Answer The Following Questions (ملحوظة هامة: الأسئلة في حدود ٣ ورقات)

The First Question

- (a) Define **Artificial Intelligence**. Explain briefly the main ideas of **Alan Turing test**.
- (b) Compare between **Strong AI** and **Weak AI**.
- (c) The tower of Hanoi problem is defined as following: We have three pegs and a number of disks of different sizes as shown in Fig. 1. The aim is to move from the starting state where all the disks are on the first peg, in size order (smallest at the top) to the goal state where all the pegs are on the third peg, also in size order. We are allowed to move one disk at a time, as long as there are no disks on top of it, and as long as we do not move it on top of a peg that is smaller than it.

Draw the complete search tree of the above assuming that the starting state is represented as (1,2,3) () (), and the goal state is () () (1,2,3).

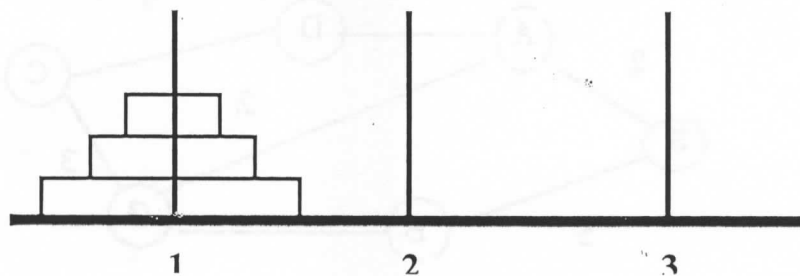


Fig.1. The tower of Hanoi problem

The Second Question

- (a) Why are **representations** so important in Artificial Intelligence? What risks are inherent in using the wrong representation?
- (b) Consider the following knowledge: "A Ford is a type of car. Bob owns two cars. Bob parks his car at home. His house is in California, which is a state. Sacramento is the state capital of California. Cars drive on the freeway, such as Route 101 and Highway 81".
  - 1) Represent the above knowledge using **semantic nets**.
  - 2) Represent the previous problem using **frame** representation.
  - 3) Compare between semantic nets representation and frame representation.
- (c) Design a suitable representation and draw the complete search tree for the following problem: A farmer is on one side of a river and wishes to cross the river with a wolf, a chicken, and a bag of grain. He can take only one item at a time in his boat with him. He can't leave the chicken alone with the grain, or it will eat the grain, and he can't leave the wolf alone with the chicken, or the wolf will eat the chicken. How does he get all three safely across to the other side?

**The Third Question**

- (a) Compare between the **depth-first** and **breadth-first** search.
- (b) Answer by true or false.
1. Breadth first search is not optimal in case actions have different cost.
  2. Greedy search is a special case of uniform cost search.
  3. If uniform cost search is complete, it is also optimal.
  4. If a heuristic function  $h()$  is admissible, greedy search is optimal.
- (c) Given the following graph in Fig. 2 where S is the starting node and G is the goal node. Numbers related to arcs between nodes indicate step costs. Trace Graph-Search algorithm using **BFS** and **DFS** strategies. In each case, show the order in which nodes are added to the fringe as well as the generated tree and the solution path. Do not add a state as a leaf if that state is on the path from the root to the current node of the generated tree. Nodes are added to the tree in alphabetical order. Indicate if found solutions are optimal.

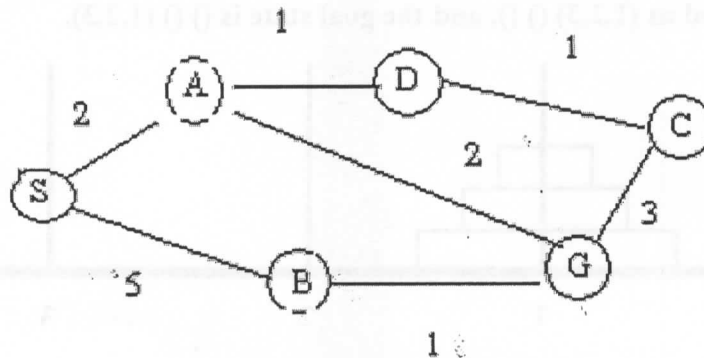


Fig. 2: Graph Representation

**The Fourth Question**

- (a) Explain the idea behind **Generate and Test**. Why is this method described as being *exhaustive*.
- (b) Consider a best first search algorithm in which the evaluation function  $f$  is given by:  
 $f(n) = (2-x)g(n) + xh(n)$
1. Assuming that  $h(n)$  is admissible, for what values of  $x$  is this algorithm guaranteed to be optimal?
  2. What kind of search does it perform when  $x = 0$ ? When  $x = 1$ ? When  $x = 2$ ?
- (c) Consider the problem of sorting numbers into ascending order as shown in Fig. 3:



Fig. 3: The problem of sorting numbers into ascending order

- State representation: a sequence of four numbers
  - Initial state: 4, 1, 3, 2.
  - Goal state: 1, 2, 3, 4.
  - Operators:
- Swapleft: swaps leftmost numbers e.g., in the initial state, 4 and 1.  
 Swapmiddle: swaps numbers in the middle e.g., in the initial state, 1 and 3.  
 Swapright: swaps rightmost numbers e.g., in the initial state, 3 and 2.

Operators should be applied in this order: Swapleft, Swapmiddle, then Swapright.

- Path cost: number of swaps.

Apply A\* search algorithm to find the minimum number of swaps required to sort the numbers. Draw the search tree, showing the nodes generated and their f-cost values. Show the content of the fringe (priority queue) at each step. The heuristic function that can be used is the Manhattan distance, the sum of the distances of the numbers from their correct locations. For instance, the heuristic value  $h(n)$  in the initial state is  $3 + 1 + 0 + 2 = 6$ .

**The Fifth Question**

- (a) What the difference between forward chaining and backward chaining. Explain the advantages and disadvantages of each method.
- (b) What is the purpose of meta rules. Would an expert system have any advantages if it knew the difference between meta rules and normal rules.
- (c) Draw a block diagram showing the architecture of an expert system.

*With my best wishes*

**Answer the following questions**

**Question (1) (15 Marks)**

- a) **Draw** a schematic diagram illustrating the memory map of PLC and **explain** briefly the function of each memory section?
- b) **Draw** the block diagram and physical circuit of
  - (i) AC/DC discrete input interface module
  - (ii) AC discrete output interface module

**Question (2) (20 Marks)**

**Draw** the PLC ladder diagram to implement a PLC system that controls a process consisting of two motors such that:

- a) Motor (M1) is running as long as limit switch LS1 is not triggering.
- b) Motor (M2) starts with LS1 action and continue running for 3 sec.
- c) After 3 sec. motor (M1) restarted and motor (M2) stopped
- d) The action is cyclic.

**Question (3) (25 Marks)**

For the system that is shown in Fig. (1), when the start pushbutton is pressed, the motor (M) will move from left to right. When LS1 (2) is (ON), the motor stops, delay for 5 seconds then move to the home. When LS1 (1) is (ON), motor cuts off and the sequence is completed. **Design** a PLC programmed ladder diagram.

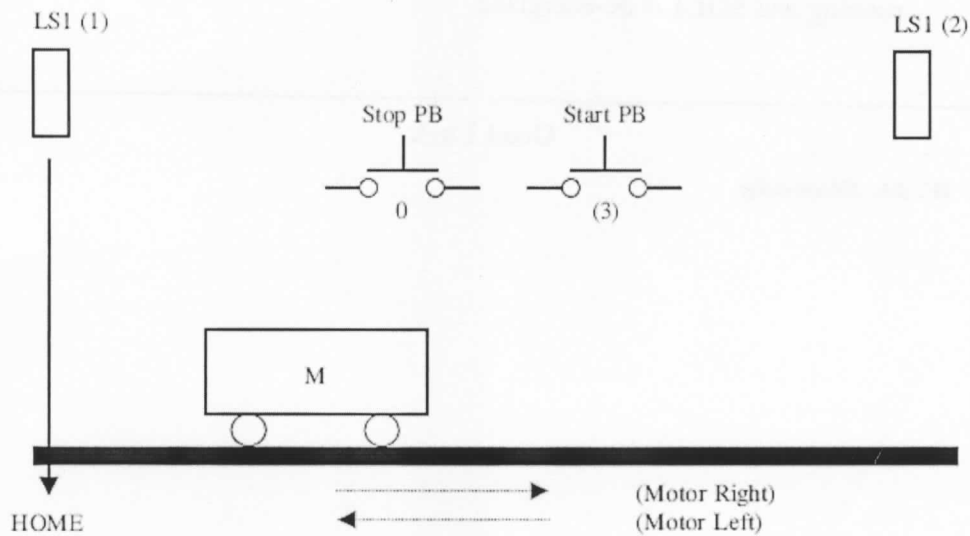


Fig. (1)



**Question (4) (25 Marks)**

For the rack configuration shown in Fig. 2, determine:

- i. The **address** for each field **input** device wired to each input connection in the 8-bit discrete input module.
- ii. The **address** for each of the **output** field devices wired to the output connections in the 8-bit discrete output module.

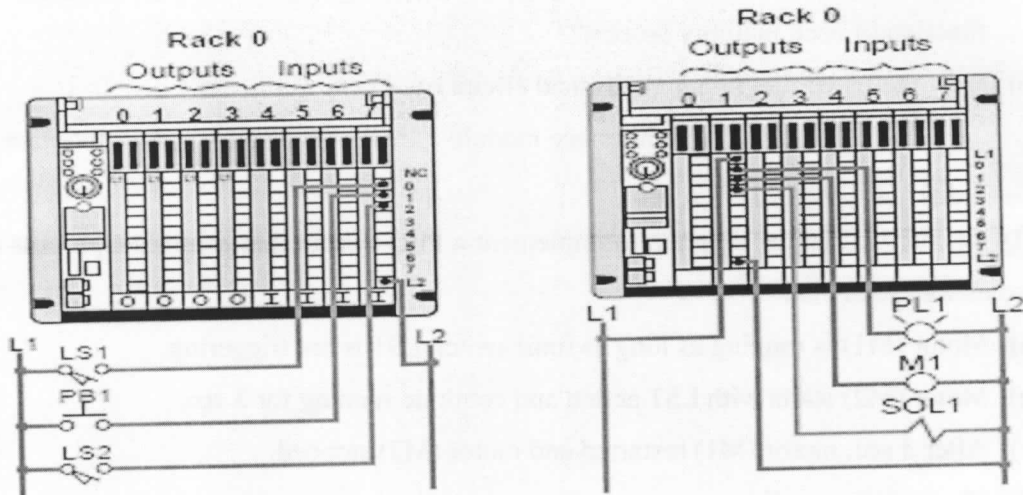


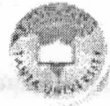
Fig. (2)

Also, draw a schematic diagram of the I/O table indicating:

- The corresponding **addresses** in the I/O table
- The **contents** of the corresponding addresses in the I/O table if the status of the I/O devices is: LS1 is open, PB1 is closed, LS2 is closed, PL1 is ON, M1 is running and SOL1 is de-energized.

Good Luck

**Dr. Eng. W. M. Elwady**



Answer all questions

Question One

- 1-Compare decision making versus problem solving. Determine whether or not it makes sense to distinguish the two from one another.
- 2-What is the difference between a problem and its symptoms? Define the term problem? What are the problem characteristics?
- 3-Explain the difference between the effective decision and efficient decisions?
- 4 - If you are a manager, How would you measure the productivity of : A salesperson - A professor - A student

Question Two

1- A wood products firm uses leftover time at the end of each week to make goods for stock. Currently, two products on the list of items are produced for stock: a chopping board and a knife holder. Both items require three operations: cutting, gluing, and finishing. The manager of the firm has collected the following data on these products:

Item	Profit/unit	Time per unit (minutes)		
		Cutting	Gluing	Finishing
Chopping Board	\$2	1.4	5	12
Knife holder	\$6	0.8	13	3

The manager has also determined that, during each week, 56 minutes are available for cutting, 650 minutes are available for gluing, and 360 minutes are available for finishing. He wants to maximize profit. (Hint: Set up a constraint table).

- (a) What are the decision variables?
  - (b) What is the objective function?
  - (c) What are the constraints?
  - (d) Find the optimal solution as LP problem?
- 2- You are about to buy a car . Follow Simon's phase model and describe the activities at each steps. Explain the support given to decision makers in each phase of decision process
- 3-List and describe the three major components of DSS.

Question Three

1-True/False Questions

1. The intelligence phase of decision making finds or recognizes a problem, need, or opportunity.
2. The choice phase of decision making considers ways to solve problems, fill needs, or take advantage of opportunities.
3. The four phases of decision making are linear and once one phase is complete it is never returned to.
4. A structured decision involves processing a certain kind of information in a specified way so that you will always get the right answer. No "feel" or intuition is necessary.
5. A recurring decision is one that happens repeatedly. and often periodically, whether weekly, monthly, quarterly, or yearly.
6. A recurring decision is one that you make infrequently and you may even have different criteria for determining the best solution each time.
7. Most decisions fall somewhere between structured and non structured.
8. A decision support system (DSS) is a highly flexible and interactive IT system that is designed to support decision making when the problem is not structured.
9. A geographic information system (GIS) is a decision support system designed specifically to work with spatial information.
10. Spatial information is any information that can be shown in its original form.

2-Multiple Choice Questions

1. Which phase of decision making finds or recognizes a problem, need, or opportunity?  
A) Intelligence  
B) Design  
C) Choice  
D) Implementation
2. Which phase of decision making considers possible ways of solving problems, filling needs, or taking advantage of opportunities?  
A) Intelligence  
B) Design  
C) Choice  
D) Implementation

3. Which phase of decision making examines and weighs the merits of each solution, estimates the consequences of each, and chooses the best one?
  - A) Intelligence
  - B) Design
  - C) Choice
  - D) Implementation
4. Which phase of decision making carries out the chosen solution, monitors the results, and makes adjustments as necessary?
  - A) Intelligence
  - B) Design
  - C) Choice
  - D) Implementation
5. Recognizing the threat of new competition is considered what phase of decision making?
  - A) Intelligence
  - B) Design
  - C) Choice
  - D) Implementation
6. Which type of decision involves processing a certain kind of information in a specified way so that you will always get the right answer?
  - A) Structured decision
  - B) Nonstructured decision
  - C) Recurring decision
  - D) Nonrecurring decision
7. Which type of decision is one for which there may be several "right" answers and there is no precise way to get a right answer?
  - A) Structured decision
  - B) Nonstructured decision
  - C) Recurring decision
  - D) Nonrecurring decision
8. Which type of decision is one that happens repeatedly, and often periodically, whether weekly, monthly, quarterly, or yearly?
  - A) Structured decision
  - B) Nonstructured decision
  - C) Recurring decision
  - D) Nonrecurring decision
9. Which type of decision is made infrequently?
  - A) Structured decision
  - B) Nonstructured decision
  - C) Recurring decision
  - D) Nonrecurring decision
10. Which of the following is not a DSS component?
  - A) Data management
  - B) Model management
  - C) Information management
  - D) User interface management

**Question Four**

1. Briefly describe transaction processing system (TPS), DSS, MIS, EIS, Expert System (ES), GDSS, and knowledge management system (KMS). Compare them on five dimensions.
2. Show the various components of a Decision Support System (DSS) in the form of a diagram. Describe each component briefly. Describe each component in greater detail.
3. Describe various decision making approaches.
4. Describe decision problems under certainty, uncertainty and risk. You should be able to formulate and solve such problems.

**Thank You Dr. Hatem 2014**