Benha University
Final Exam
Class: 4th Year (information System)
Subject: Crisi Management

Faculty of Computers & Informatics
Date: 9/6 /2013
Time: 3 hours
Examiner: Dr. Sahar Fawzy

Question One

1- Given the following access characteristics and access frequencies for Q1,...,Q4, calculate the optimal vertical splitting using the Bond Energy Algorithm (BEA),

Steps :

a. Prepare an affinity matrix.
b. Apply BEA algorithm.
c. Perform vertical splitting by maximizing the split quality.

	Name	*Family*	*Age*	*Position*	*Location*
Q1	1	1	1	0	0
Q2	0	0	1	1	0
Q3	0	1	0	1	1
Q4	0	0	1	0	1

	Site A	*Site B*	*Site C*
Q1	20	1	0
Q2	10	5	9
Q3	80	1	9
Q4	2	5	4

➔ solution

	A1	A2	A3	A4	A5
A1	21	21	21	0	0
A2	21	111	21	90	90
A3	21	21	56	24	11
A4	0	90	24	114	90
A5	0	90	11	90	101

Place attributes:
place A1
contribution at pos 0 = 2121
contribution at pos 1 = -1598
contribution at pos 2 = 2058
attribute A1 is placed at pos 0: [A1, A5, A3]
place A2

contribution at pos 0 = 3213
contribution at pos 1 = 28503
contribution at pos 2 = 28732
contribution at pos 3 = 7098
attribute A2 is placed at pos 2: [A1, A5, A2, A3]
place A4
contribution at pos 0 = 2394
contribution at pos 1 = 27987
contribution at pos 2 = 29157
contribution at pos 3 = 28716
contribution at pos 4 = 6960
attribute A4 is placed at pos 2: [A1, A5, A4, A2, A3]
resulting order: [A1, A5, A4, A2, A3]

find fragments:
split at [A1, A2, A3, A4] | [A5]
accesses frag1 alone: 45
accesses frag2 alone: 0
accesses frag1 and frag2: 101
split quality = -10201

split at [A1, A2, A3] | [A4, A5]
accesses frag1 alone: 21
accesses frag2 alone: 0
accesses frag1 and frag2: 125
split quality = -15625

split at [A1, A3] | [A2, A4, A5]
accesses frag1 alone: 0
accesses frag2 alone: 90
accesses frag1 and frag2: 56
split quality = -3136

split at [A1] | [A2, A3, A4, A5]
accesses frag1 alone: 0
accesses frag2 alone: 125
accesses frag1 and frag2: 21
split quality = -441

split at [A1, A2, A3, A5] | [A4]
accesses frag1 alone: 32
accesses frag2 alone: 0
accesses frag1 and frag2: 114
split quality = -12996

split at [A1, A3, A5] | [A2, A4]

accesses frag1 alone: 11
accesses frag2 alone: 0
accesses frag1 and frag2: 135
split quality = -18225

split at [A1, A5] | [A2, A3, A4]
accesses frag1 alone: 0
accesses frag2 alone: 24
accesses frag1 and frag2: 122
split quality = -14884

split at [A1, A3, A4, A5] | [A2]
accesses frag1 alone: 35
accesses frag2 alone: 0
accesses frag1 and frag2: 111
split quality = -12321

split at [A1, A4, A5] | [A2, A3]
accesses frag1 alone: 0
accesses frag2 alone: 0
accesses frag1 and frag2: 146
split quality = -21316

split at [A1, A2, A4, A5] | [A3]
accesses frag1 alone: 90
accesses frag2 alone: 0
accesses frag1 and frag2: 56
split quality = -3136
optimal split(s) (sq = -441):
[A1] | [A2, A3, A4, A5]

2- "*Fault-tolerant systems - ideally systems capable of executing their tasks correctly regardless of either hardware failures or software errors*" **in the context of this statement discuss:**

a. **Strategies to Handle Faults**

➔ **Fault avoidance**

Techniques aim to prevent faults from entering the system during design stage.

➔ **Fault removal**

Methods attempt to find faults within a system before it enters service

➔ **Fault detection**

Techniques used during service to detect faults within the operational system

➔ **Fault tolerant**

Techniques designed to tolerant faults, i.e. to allow the system operate correctly in the presence of faults.

b. **Fault Tolerance Measures**

➔ Fault tolerance is related to dependability which Includes

- **Reliability**

  Reliability, R(t): – property that a system can run without failure, for a given time.

  Related measure - Mean Time To Failure, MTTF :

  Average time the system remains up before it goes down and has to be repaired or replaced
- **Availability**: availability is used in systems with recovery/repair
  - Related measures:
    - Mean Time To Repair, MTTR
    - Mean Time Between Failures, MTBF = MTTF + MTTR
- **Safety:** A measurement of *how safe failures are*
  - System fails, nothing serious happens
  - For instance, high degree of safety is required for systems controlling nuclear power plants
- **Maintainability:** A measurement of *how easy it is to repair a system*
    - A highly maintainable system may also show a high degree of availability
    - Failures can be detected and repaired automatically? Self-healing systems?

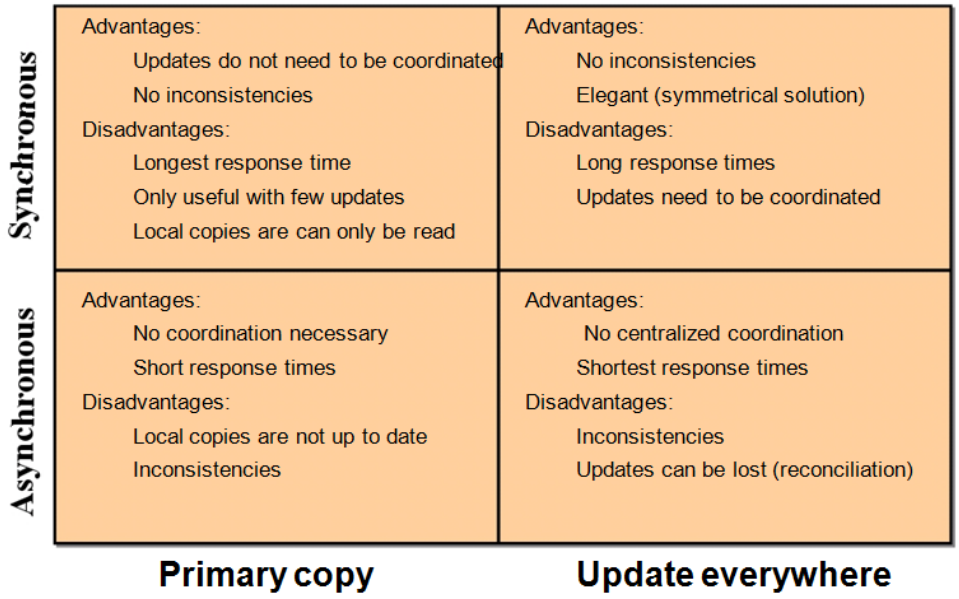
3- What's data replication and why is replication? ***Explain briefly*** replication strategies?

➔ Replication is a common strategy in data management: RAID technology Redundant Array of Independent Disks) and Mirror sites for web pages.

➔ Why replication?

a) PERFORMANCE: Location transparency is difficult to achieve in a distributed environment. If everything is local, then all accesses should be fast.
b) FAULT TOLERANCE: Failure resilience is also difficult to achieve. If a site fails, the data it contains becomes unavailable. By keeping
c) APPLICATION TYPE: Databases have always tried to separate queries form updates to avoid interference. This leads to two different

Replication Strategies



4- A 12-bit hamming code word containing 8 bits of data and 4 parity bits is. what's the original data if the code word is:

i. 010101100011

1	2	3	4	5	6	7	8	9	10	11	12
0	1	0	1	0	1	1	0	0	0	1	1

➔ C1= XOR(1,3,5,7,9,11)= XOR(0,0,0,1,0,1)=0
➔ C2 = XOR (2,3 , 6,7, 10,11)= XOR(1,0,1,1,0,1)= 0
➔ C4= XOR(4,5,6,7,12) = XOR(1,0,1,1,1)= 0
➔ C8 = XOR(8,9,10,11,12)= XOR(0,0,0,1,1)= 0

Message is correct

ii. 111110001100

1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	1	0	0	0	1	1	0	0

➔ C1= XOR(1,3,5,7,9,11)= XOR(1,1,1,0,1,0)=0
➔ C2 = XOR (2,3 , 6,7, 10,11)= XOR(1,1,0,0,1,0)=1
➔ C4= XOR(4,5,6,7,12)= XOR(1,1,0,0,0)=0
➔ C8 = XOR(8,9,10,11,12)=XOR(0,1,1,0,0)=0

Error at 2nd bit

i. 000010001010

1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	1	0	0	0	1	0	1	0

➔ C1= XOR(1,3,5,7,9,11)= XOR(0,0,1,0,1,1) = 1
➔ C2 = XOR (2,3 , 6,7, 10,11)= XOR(0,0,0,0,0,1) = 1
➔ C4= XOR(4,5,6,7,12)= XOR(0,1,0,0,0) = 1
➔ C8 = XOR(8,9,10,11,12)= XOR(0,1,0,1,0) = 0

Error at the 7th bit

Question Two

1. **What's token passing protocol? How can this protocol work assuming different types of failures can occur.**
   - ➔ † The token based protocol is used as an example of replication in distributed systems to illustrate the problems of fault-tolerance and starvation.
   - ➔ **Failures:**
     - If communication failures occur, the token may disappear while in transit (message is lost).
     - First, the loss of the token must be detected
     - Second, the token must be regenerated
     - Third, after the regeneration, there must be only one token in the system (only one master copy)
     - To do this, logical clocks are used:
     - OwnerTime(s) is a logical clock associated with the token, it indicates when sites sent or received the token
     - TokenState(s) is the state of the shared resource (values associated with the token itself)

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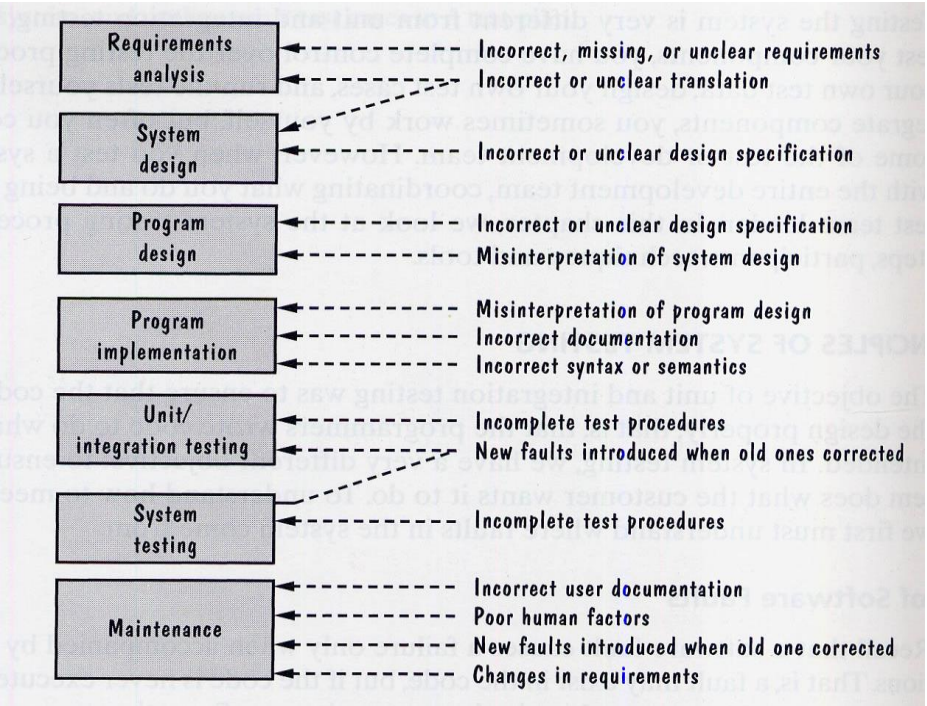
2. ***What's software testing? What are the causes of software faults?***

Software testing is executing software in a simulated or real environment, using inputs selected somehow. The main causes of software faults are:



3. **Obtain the CRC code word for the data bit sequence 00101100010101110100011 (left most bit is the least significant) using the generator polynomial $x^5 + x^2 + 1$. *For the resulted codeword show the steps performed by the receiver to check message correctness.***

M = 00101100010101110100011

k=100101

```
100101 |00101100010101110100011
          100101
          ------
          00100101
            100101
            ------
            0000000101110
                   100101
                   ------
                   00101110
                     100101
                     ------
                     00101100
                       100101
                       ------
                       00100111
                         100101
                         ------
                            000010    remainder = message is incorrect
```

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4. **Suppose the following block of 16 bit is to be sent, using checksum of 8 bit (1 0 0 0 1 0 0 1 - 1 1 1 1 0 0 0 0 - 0 0 1 1 1 1 0 0 - 1 0 1 0 0 0 0 1) what will be the sent message?**

```
1 0 0 0 1 0 0 1   W1
1 1 1 1 0 0 0 0   W2
-----------------------------------------------------------------
1 0 1 1 1 1 0 0 1   Normal sum
              1   Carry
-----------------------------------------------------------------
  0 1 1 1 1 0 1 0   1's Comp sum W1, W2
  0 0 1 1 1 1 0 0    W3
-----------------------------------------------------------------
  1 0 1 1 0 1 1 0   1's Comp sum W1, W2, W3
  1 0 1 0 0 0 0 1    W4
-----------------------------------------------------------------
1 0 1 0 1 1 0 0 1   Normal sum
              1   Carry
-----------------------------------------------------------------
  0 1 0 1 1 0 1 0   1's Comp sum W1, W2, W3, W4
  1 0 1 0 0 1 0 1   complement
                        = checksum of W1-W4
```

Best Wishes & Good Luck

Dr. Sahar