***King Fahd University of Petroleum and Minerals***

***College of Computer Science and Engineering***

***Computer Engineering Department***

**COE 202: Digital Logic Design (3-0-3)**

**Term 111 (FALL 2011)**

**Major Exam 1**

**Thursday October 13, 2011**

**Time: 90 minutes, Total Pages: 6**

**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ID:\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Section: \_\_\_\_\_\_\_**

**Notes:**

* Do not open the exam book until instructed
* **Calculators are not allowed** (*basic, advanced, cell phones, etc*.)
* Answer all questions
* All steps must be shown
* Any assumptions made must be clearly stated

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum Points** | **Your Points** |
| **1** | **22** |  |
| **2** | **14** |  |
| **3** | **14** |  |
| **4** | **11** |  |
| **5** | **14** |  |
| **Total** | **75** |  |

**Question 1. (22 points)**

Convert the following numbers from the given base to the other uncrossed bases listed in the table (if needed, express fractions up to 3 digits only). Show your solution steps below the table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Decimal** | **Binary** | **Octal** | **Hexadecimal** | **BCD**  **(8421)** |
| 37.3 |  |  |  |  |
|  | 1010101.011 |  |  |  |
|  |  | 275.2 |  |  |
|  |  |  |  | 00010100 |

**Question 2. (14 points)**

Perform the following arithmetic operations in the specified number system.

|  |  |  |  |
| --- | --- | --- | --- |
| Octal  Addition  1775  +1734  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Hexadecimal  Subtraction  FA3B  - 27E9  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Binary  Subtraction  11010011  - 10000101  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Binary  Multiplication  1101  × 1100  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Question 3. (14 points)**

1. Draw the logic implementation of the function below (*use F as is,* ***do not simplify***):



1. Obtain the complement of the following function (***Don’t Simplify***):

**

1. *Using Algebraic manipulation*, simplify the following function to **three** literals:



**Question 4. (11 points)**

1. Given the SOP Boolean function
   1. Express the function as a POS
   2. Express the function as a sum of minterms
2. Given the function
   1. Express F as a product of Maxterms
   2. Give the *algebraic* product of Maxterms expression for F.
   3. Express as a sum of minterms and product of Maxterms

**Question 5. (14 points)**

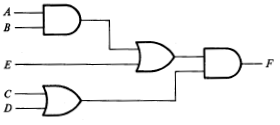
**Fill in the Spaces: (Show all work needed to obtain your answer)**

a. Given that, then the function F is 1 at \_\_\_\_\_\_\_\_\_ (how many) rows in its truth table.

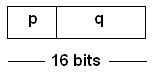
b.



c. The logic circuit shown below is an example of \_\_\_\_\_\_ (how many) - level logic. If all gates have the same propagation delay of 2 ns, then the circuit takes \_\_\_\_\_\_\_\_\_ ns to produce the correct output.



d. Before sending the data 1011001 over a communication link using **even** parity, the transmitter appends a parity check bit equal to \_\_\_\_\_\_ (0/1) to it.



e. A 16-bit international character code consists of p bits to represent the language and q bits to represent the character. If no language requires more than 350 characters, then it is possible to support up to \_\_\_\_\_\_\_\_\_ (how many) languages.

f. For functions of the logic variables V, W, X, Y, Z, the maxterm M3 is given in the algebraic form as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

g. The function  can be simplified to the single maxterm: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.