***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 162 (Winter 2016)**

**Major Exam 1**

**Saturday, March 11th, 2017**

**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** | **12** |  |
| **2** | **17** |  |
| **3** | **19** |  |
| **Total** | **48** |  |

**Question 1: Fill in the Spaces: (Show all work needed to obtain your answer) [14 marks]**

1. The decimal number 15 is represented in **BCD** as **\_\_\_\_\_\_\_\_\_** (Fill in the space). **(1 Point)**
2. Given and then

) (write as a sum-of-minterms)**(2 Points)**

1. The data **001010** (which contains **EVEN** parity for error detection) was sent **four** times. The received data (for these 4 times) are shown below from **a** to **d**, circle **ALL** the data that the receiver **can’t detect** as being wrong: **(2 Point)**
2. **101010 b) 001011 C) 110011 d) 000000**
3. What is the minimum number of bits required to represent the **360** Latitudes? **\_\_\_\_\_\_** . The number of unused codes will be **\_\_\_\_\_\_\_** (Fill in the spaces) **(2 Point)**
4. Given that (521)**X** = (337)**10**, then the Base **X** is (circle one): **(2 Point)**
5. **4 b) 16 C) 8 d) 6**
6. **For the Logic Diagram Below:
7. **The logic function F = \_\_\_\_\_\_\_\_\_\_\_\_\_** (as in the logic diagram without anyre-arrangement) **(1 Point)**
8. This circuit has **\_\_\_**  number of logic levels (Fill in the space) **(1 Point)**
9. Assuming that all gates have a delay of 1 (each), then the longest path’s (i.e. critical path) delay = **\_\_**  **(1 Point)**

**Question 2. (17 Points)**

1. Convert the following numbers from the given base to the other uncrossed bases listed in the table (**if needed**, express fractions up to **4 bits** only). Show your solution steps below the table. **(11 Points)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Decimal** | **Binary** | **Octal** | **Hexadecimal** | **BCD** |
| **105.25** |  |  |  |  |
|  | **11010.001** |  |  |  |
|  |  |  | **63.A** |  |
|  |  |  |  | 10010110 |

**2)** Perform the following arithmetic operations in the specified number system. **(6 Points)**

|  |  |  |
| --- | --- | --- |
| Hexadecimal  Addition  B3  + 9A  --------------- | Binary  Subtraction  100001  - 010011  ------------------ | Binary  Multiplication  1101  × 0101  ---------------- |

**Question 3. (19 Points)**

1. Using Boolean Algebraic manipulations, **minimize** the following two functions to **minimum** number of literals in **sum of products** representation (**show your work clearly step by step**):
2. **(4 Points)**
3. **(4 Points)**

1. Find the **complement** of the following function F without performing any simplification : **(2 Points)**

1. Given the function F(A,B,C) represented in the given truth table: **(4 Points)**

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | F |
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

1. Express **F** in **algebraic form** as a **sum-of-minterms. (2 Points)**
2. Express **F** in **algebraic form** as a **product of maxterms***.* **(2 Points)**
3. Using **Canonical forms**, determine whether the following two functions are equivalent or not: **(5 Points)**