**CS 3173 Basic Computer Architecture Exam 2 100 points**

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**Due 10/2 11:59pm No late exams accepted Microsoft Word format only accepted**

**Part 1: Programming in Java:**

1. *(20 points)*

Write a Java program to use the Boolean data type for A and B and get input from the user. Use statements representing the four logic gates below:

A && B A || B (A || B) && (A && B) (A || B) || (A || B)

1. **import** java.util.Scanner;
3. **public** **class** Exam2 {
4. **public** **static** **void** main(String[] args) {
5. Scanner scan = **new** Scanner(System.in);
6. **boolean** a = **false**;
7. **boolean** b = **false**;
9. System.out.println("\nPlease enter \"true\" or \"false\"");
11. **for** (**int** i = 0; i < 2; i++) {
12. **if** (i == 0) System.out.print("A = ");
13. **else** **if** (i == 1) System.out.print("B = ");
15. String in = scan.nextLine().toLowerCase();
16. **if** (in.equals("false")) **continue**;
17. **if** (in.equals("true")) {
18. **if** (i == 0) a = **true**;
19. **else** **if** (i==1) b = **true**;
20. }
21. **else** {
22. System.out.println("Please enter \"true\" or \"false\"");
23. i--;
24. }
25. }
27. System.out.println("\nA = "+a+", B = "+b);
28. System.out.println("\nA && B = " + (a && b));
29. System.out.println("A || B = " + (a || b));
30. System.out.println("(A || B) && (A && B) = " + ((a || b) && (a && b)));
31. System.out.println("(A || B) || (A || B) = " + ((a || b) || (a || b)));
32. }
33. }
34. *(20 points)* Write a Java program to create the adder variant shown by the equation for Sum below:

Use the Boolean data type for A, B, Cin. Use java  **!** to represent negation Use java **||** to represent + (OR)

Use java && to represent multiplication (AND)

1. **import** java.util.Scanner;
3. **public** **class** Exam2 {
4. **public** **static** **void** main(String[] args) {
5. Scanner scan = **new** Scanner(System.in);
6. **boolean** a = **false**;
7. **boolean** b = **false**;
8. **boolean** c\_in = **false**;
10. System.out.println("\nPlease enter \"true\" or \"false\"");
12. **for** (**int** i = 0; i < 3; i++) {
13. **if** (i == 0) System.out.print("A = ");
14. **else** **if** (i == 1) System.out.print("B = ");
15. **else** **if** (i == 2) System.out.print("Carry-in = ");
17. String in = scan.nextLine().toLowerCase();
18. **if** (in.equals("false")) **continue**;
19. **if** (in.equals("true")) {
20. **if** (i == 0) a = **true**;
21. **else** **if** (i == 1) b = **true**;
22. **else** **if** (i == 2) c\_in = **true**;
23. }
24. **else** {
25. System.out.println("Please enter \"true\" or \"false\"");
26. i--;
27. }
28. }
30. // Sum = ¬A ∙ B ∙ ¬C\_in + A ∙ B ∙ C\_in + A ∙ ¬B ∙ ¬C\_in
31. //     = (!a && b && !c\_in) || (a && b && c\_in) || (a && !b && !c\_in)
32. System.out.println("\nA = " + a + ", B = " + b + ", Carry-in = " + c\_in);
33. System.out.println("\nSum = " +
34. ((!a && b && !c\_in) || (a && b && c\_in) || (a && !b && !c\_in)));
35. }
36. }

**Part 2: Questions and Problem Solving:**

1. *(5 points)* What is the one’s complement of the following binary number? 1 0 0 1

**0 1 1 0**

1. *(5 points)* What is the two’s complement of the following binary number? 1 0 1 0

**0 1 1 0**

1. *(5 points)* What is a decoder?

**A circuit that takes an input of n bits and outputs 2n bits**

1. *(5 points)* What is an active low circuit?

**A circuit that is active when the signal is off or ‘low,’ and not active when the signal is on or ‘high.’**

1. *(5 points)* What is a multiplexer?

**A circuit that routes multiple inputs into a single output. Selection lines are used to choose which data input is transmitted to the data output.**

1. *(5 points)* How many bits per segment are needed for input?

**In a 7-segment display, 4 bits are needed per segment for input.**

1. *(15 points)* Write the truth table for the following logic gate circuit representations:

A B A and B A or B (A and B) or (A and B) (A or B) or (A or B)

T T  **T T T T**

T F **F T F T**

F T  **F T F T**

F F **F F F F**

1. *(15 points)* Write the truth table for the following logic gate circuit representations:

A B A and B A xor B (A and B) xor (A and B) (A xor B) xor (A xor B)

T T  **T F F F**

T F  **F T F F**

F T  **F T F F**

F F  **F F F F**