Number system, Conversion, Complements, r's and r-1's complement. Subtraction using r's complement

1. The binary equivalent of decimal number 45 is:
A) 101001
B) 101101
C) 110101
D) 101011
E) 111001
Answer: B) 101101

2. The decimal equivalent of binary number 11001 is:
A) 21
B) 24
C) 25
D) 27
E) 31
Answer: C) 25

3. The octal equivalent of binary number 101110 is:
A) 46
B) 54
C) 56
D) 72
E) 64
Answer: B) 56

4. Which number system is most suitable for designing digital circuits at the hardware level?
A) Decimal
B) Binary
C) Octal
D) Hexadecimal
E) Gray Code
Answer: B) Binary

5. The 1's complement of binary number 1011001 is:
A) 0100110
B) 1100110
C) 0101001
D) 1110001
E) 1001110
Answer: A) 0100110

6. The 2's complement of binary number 100110 is:
A) 011010
B) 011001
C) 0110100
D) 0110101

E) 011111
Answer: B) 011010

7. Which of the following is the 10’s complement of decimal number 3256 (4-digit system)?
A) 6743
B) 6744
C) 6754
D) 6756
E) 6742
Answer: B) 6744

8. Which of the following is the (r–1)’s complement of octal number $(325)_8$ (base 8)?
A) $(452)_8$
B) $(452)_8$
C) $(452)_8$
D) $(452)_8$
E) $(452)_8$

Answer: A) $(452)_8$

9. Perform subtraction using 2’s complement: $(1001)_2 – (0101)_2$
A) $(0100)_2$
B) $(0010)_2$
C) $(0110)_2$
D) $(1010)_2$
E) $(1000)_2$
Answer: B) $(0100)_2$

10. Perform subtraction using 10’s complement: (7256 – 4321).
A) 2935
B) 2934
C) 2925
D) 2926
E) 2936
Answer: A) 2935

11. Which statement is correct about complements?
A) r’s complement is obtained by subtracting a number from r^n.
B) (r–1)’s complement is always 1 less than r’s complement.
C) 2’s complement is the same as 1’s complement plus 1.
D) 10’s complement is useful for decimal subtraction.
E) All of the above.
Answer: E) All of the above

12. A circuit uses 2's complement representation. If 10110100 is stored in an 8-bit register, its decimal value is:
A) -76
B) 180
C) -180
D) 76

E) 92
Answer: A) -76

13. Convert the binary number 1101.101 into its decimal equivalent**.**
A) 13.625
B) 14.25
C) 12.75
D) 15.125
E) 11.875
Answer: A) 13.625

14. A digital system stores the value 11101010 in an 8-bit 2's complement register. Determine the decimal value.
A) -22
B) 234
C) -86
D) -21
E) 22
Answer: C) -86

15. $(3F)_{16}$ is equivalent to binary $(\ )_2$:
A) 00111111
B) 11000011
C) 00110011
D) 11110000
E) 10101010
Answer: A) 00111111

99Boolean Logic, Boolean algebra

1. Which of the following Boolean expressions represents the NOR gate?
A) (A + B)'
B) A'·B'
C) (A·B)'
D) A' + B'
E) A·B
Answer: A) (A + B)'

2. Apply De Morgan's Theorem to (A + B)' and choose the correct equivalent.
A) A'·B'
B) A' + B'
C) (A·B)'
D) A·B
E) (A' + B')'
Answer: A) A'·B'

3. If a digital circuit outputs logic 1 only when exactly one of its two inputs is 1, the logic function is:
A) AND
B) OR
C) XOR
D) NAND
E) NOR
Answer: C) XO

4. Apply De Morgan's Theorem to (A + B)' and choose the correct equivalent:
A) A'·B'
B) A' + B'
C) (A·B)'
D) A·B
E) (A' + B')'
Answer: A) A'·B'

5. Which logic gate has the truth table output 0, 1, 1, 1 for inputs 00, 01, 10, 11?
A) AND
B) OR
C) XOR
D) NAND
E) NOR
Answer: B

6. The basic Boolean operations are:
A) AND, OR, NOT
B) NAND, NOR, XOR
C) Addition, Subtraction, Multiplication
D) Shift, Rotate, Complement

E) Buffer, Encoder, Decoder
Answer: A) AND, OR, NOT

7. Which of the following is the identity element of Boolean algebra?
A) 1 for AND, 0 for OR
B) 0 for AND, 1 for OR
C) 0 for AND, 0 for OR
D) 1 for AND, 1 for OR
E) None of the above
Answer: B) 0 for AND, 1 for OR

8. The expression A + A' is equal to:
A) 0
B) 1
C) A
D) A'
E) None
Answer: B) 1

9. The expression A·A' is equal to:
A) 0
B) 1
C) A
D) A'
E) None
Answer: A) 0

10. The dual of the Boolean expression A + 0 = A is:
A) A·0 = 0
B) A·1 = A
C) A + 1 = A
D) A·0 = A
E) A·A = A
Answer: B) A·1 = A

11. According to De Morgan's Theorem, (AB)' = ?
A) A' + B'
B) A'·B'
C) (A' + B)'
D) A + B
E) AB
Answer: A) A' + B'

12. The Boolean expression for an **Exclusive OR (XOR)** gate is:
A) A + B
B) AB + A'B'
C) A'B + AB'
D) (A + B)'
E) AB
Answer: C) A'B + AB'

13. Which of the following is the complement of (A + B)?
A) (A + B)’
B) A’ + B’
C) A’·B’
D) AB
E) (AB)’
Answer: C) A’·B’

14. The absorption law in Boolean algebra is:
A) A + AB = A
B) A(A + B) = A
C) Both A and B
D) A + A = A
E) A·A = A
Answer: C) Both A and B

15. Which Boolean law justifies the simplification of A + A’·B to A + B?
A) Distributive Law
B) Absorption Law
C) Idempotent Law
D) Consensus Theorem
E) De Morgan’s Law
Answer: D) Consensus Theorem
16. What is the simplified value of the Boolean expression A·B + A·B’?
A) A
B) B
C) 1
D) A’
E) B’
Answer: A) A

17. The Boolean expression X + X′Y simplifies to:
A) X + Y
B) X
C) Y
D) X′Y
E) 1
Answer: A) X + Y

18. Simplify the equation F = A′B + AB′ + AB using Boolean algebra.
A) A + B
B) A ⊕ B
C) A + B′
D) A′ + B
E) AB

Answer: A) A + B

K-map Introduction and Boolean function minimization

1. In a 4-variable K-map, what is the largest possible group size?
A) 1
B) 2
C) 4
D) 8
E) 16
Answer: E) 16

2. In a 2-variable K-map, minterms m(2, 3) correspond to which simplified Boolean expression?
A) A
B) B
C) A'
D) B'
E) A·B
Answer: A) A

3. In a 2-variable K-map, minterms m(0, 2, 3) correspond to which simplified Boolean expression?
A) A + B′
B) A + B
C) A′ + B
D) A′ + B′
E) A ⊕ B
Answer: B) A + B

4. Simplify the Boolean function using K-map:
F(A, B) = Σm(1, 2)
A) A + B
B) A·B
C) A ⊕ B
D) A' + B'
E) A + B'
Answer: C) A ⊕ B

5. (2-variable) Simplify:
F(A, B) = Σm(0, 1, 3)
A) A + B
B) A + B'
C) A' + B
D) A' + B'
E) AB
Answer: B) A + B'

6. (3-variable) Simplify the Boolean function:
F(A, B, C) = Σm(1, 3, 5, 7)
A) A·C + B
B) A + C
C) A ⊕ B ⊕ C
D) B·C
E) A + B
Answer: C) A ⊕ B ⊕ C

7. (3-variable) Simplify:
F(A, B, C) = Σm(0, 2, 4, 6)
A) A·B’
B) A’·B’
C) B’
D) A + B
E) C
Answer: C) B’

8. (3-variable) Simplify using K-map:
F(A, B, C) = Σm(1, 3, 4, 6)
A) A + C
B) B + C
C) A·B + B·C
D) B·C + A·B’
E) A + B
Answer: D) B·C + A·B’

9. (4-variable) Simplify the function:
F(A, B, C, D) = Σm(0, 1, 2, 5, 6, 7, 8, 9, 10, 13, 14, 15)
A) A + C
B) B + D
C) A + B
D) A·B + C·D
E) A·C + B·D
Answer: C) A + B

10. (4-variable) F(A, B, C, D) = Σm(1, 3, 7, 11, 15)
A) A·C + B·D
B) A·B + C·D
C) A·D + B·C
D) A·B·C + D
E) A ⊕ B ⊕ C ⊕ D
Answer: E) A ⊕ B ⊕ C ⊕ D

11. (4-variable) F(A, B, C, D) = Σm(0, 2, 8, 10)
A) A’·C’
B) A’·C
C) A·C’
D) B’·D’
E) A·B
Answer: A) A’·C’

12. (3-variable) Simplify:
F(A, B, C) = Σm(0, 1, 2, 3, 5, 7)
A) A + C
B) B + C
C) A + B
D) A·B + B·C
E) B’ + C
Answer: B) B + C

13. (2-variable) Simplify:
F(A, B) = Σm(0, 2)
A) A + B
B) A’ + B’
C) A·B
D) A’·B’
E) A ⊕ B
Answer: D) A’·B’