

Class 11

Chapter – 1

Data Representation

Multiple Choice Answers(page 54-57)

1. **(b) Decimal**
2. **(c) 0–1**
3. **(b) Binary**
4. **(c) Octal**
5. **(d) Hexadecimal**
6. **(c) 0–9, A–F**
7. Convert 2510_{25} to binary:
 $2510_{10} = 11001225_{10} = 11001_2 22510 = 110012$
Answer: **(a) 11001**
8. Convert 101021010_2 to decimal:
 $10102 = 10101010_2 = 10_{10} 10102 = 1010$
Answer: **(c) 10**
9. Convert $(2F)_{16}$ to decimal:
 $(2F)_{16} = 47_{10}$
Answer: **(a) 47**
10. Convert $(57)_8$ to decimal:
 $(57)_8 = 47_{10}$
Answer: **(a) 47**
11. Convert $(1111)_2$ to hexadecimal:
 $1111_2 = F_{16}$
Answer: **(a) F**
12. **(b) Flipping all bits**
13. **(b) –7 to +7**
14. **(a) 1001**
15. **(b) Has two representations for zero (+0 and –0)**
16. **(b) Flipping all bits and adding 1**
17. **(a) –8 to +7**
18. **(b) It eliminates the problem of two zeros**
19. Represent –6 in 4-bit two's complement:
 $-6_{10} = 1010_2 - 6_{10} = 1010_2 - 6_{10} = 1010_2$
Answer: **(a) 1010**
20. Represent –6 in 4-bit sign-magnitude form:
 $-6_{10} = 1110_2 - 6_{10} = 1110_2 - 6_{10} = 1110_2$
Answer: **(b) 1110**
21. **(b) Sign of the number**
22. Represent –9 in 5-bit sign-magnitude form:
 $-9_{10} = 11001_2 - 9_{10} = 11001_2 - 9_{10} = 11001_2$
Answer: **(b) 11001**
23. **(b) Floating point**
24. **(b) Fractional part**
25. Binary addition:
 $10112 + 1102 = 100012$
Answer: **(a) 10001**

26. Binary subtraction:
 $10102-01102=01002$
Answer: (a) **0100**
27. (a) **7**
28. (b) **All world languages**
29. (b) **Indian scripts**

Competency-Focused Questions

30. Convert 45 into binary:
 $45_{10}=101101_{2}$
Answer: (a) **101101**
31. Convert $(2D)_{16}$ into decimal:
 $(2D)_{16}=45_{10}$
Answer: (d) **45**
32. Result of $10112+11012$:
 $10112+11012=110002$
Answer: (c) **11000**
33. Compute $11012-01102$:
 $11012-01102=01112$
Answer: (b) **0111**
34. (c) **Mantissa/significand**
35. (a) **ASCII**

Assertions and Reasons

- (a) Both A and R are true and R is the correct explanation of A.
- (a) Both A and R are true and R is the correct explanation of A.
- (a) Both A and R are true and R is the correct explanation of A.
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- (a) Both A and R are true and R is the correct explanation of A.
- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (a) Both A and R are true and R is the correct explanation of A.
- (a) Both A and R are true and R is the correct explanation of A.
- (a) Both A and R are true and R is the correct explanation of A.
- (d) A is false but R is true.
- (b) Both A and R are true but R is not the correct explanation of A.
- (a) Both A and R are true and R is the correct explanation of A.
- (d) A is false but R is true.
- (a) Both A and R are true and R is the correct explanation of A.

Assignments:-

Type A: Very Short Answer Questions

DATA REPRESENTATION – COMPLETE SOLUTIONS WITH EXPLANATION TYPE A : VERY SHORT ANSWER QUESTIONS

1. What are the bases of decimal, octal, binary and hexadecimal systems?

Answer:

- Decimal → Base 10
- Octal → Base 8
- Binary → Base 2
- Hexadecimal → Base 16

Explanation:

The base of a number system tells how many symbols are used.

- Decimal uses digits 0–9 → 10 symbols
- Binary uses 0 and 1 → 2 symbols
- Octal uses 0–7 → 8 symbols
- Hexadecimal uses 0–9 and A–F → 16 symbols

2. What is the common property of decimal, octal, binary and hexadecimal?

Answer:

All are positional number systems.

Explanation:

The value of a digit depends on:

1. The digit itself
2. Its position in the number

Example:

In 345,

- 5 means 5 ones
- 4 means 4 tens
- 3 means 3 hundreds

3. Complete the sequence of following binary numbers:

100, 101, 110, _____, _____, _____

Answer:

111, 1000, 1001

Explanation:

Binary counting:

- $100 = 4$
- $101 = 5$
- $110 = 6$
- $111 = 7$
- $1000 = 8$
- $1001 = 9$

4. Complete the sequence of following octal numbers:

525, 526, 527, _____, _____, _____

Answer:

530, 531, 532

Explanation:

Octal system uses digits from 0 to 7.

After 527, the next number becomes 530.

5. Complete the sequence of following hexadecimal numbers:

17, 18, 19, _____, _____

Answer:

1A, 1B

Explanation:

Hexadecimal digits:

0–9, A, B, C, D, E, F

After 19:

- 1A
- 1B

6. When and why are octal and hexadecimal numbers preferred over binary numbers?

Answer:

Octal and hexadecimal numbers are preferred when writing long binary numbers.

Explanation:

They make binary numbers shorter and easier to read.

Example:

Binary: 111111110101

Hexadecimal: FF5

7. Encode “SHAG” and “GIA” into ASCII code form.

Answer:

ASCII values:

- S = 83
- H = 72
- A = 65
- G = 71

SHAG → 83 72 65 71

- G = 71
- I = 73

- A = 65
- GIA → 71 73 65

8. ASCII code is _____ bit code.

Answer:

7-bit code

Explanation:

Traditional ASCII uses 7 bits and represents 128 characters.

9. What is the use of ASCII code?

Answer:

ASCII code is used to represent characters in computers.

Explanation:

Every character is assigned a numeric value.

Example:

A = 65

B = 66

10. What is the full form of ASCII and EBCDIC?

Answer:

ASCII → American Standard Code for Information Interchange

EBCDIC → Extended Binary Coded Decimal Interchange Code

11. What does a word represent?

Answer:

A word represents a group of bits processed together by the computer.

12. What is ISCII? How many bits are used by ISCII?

Answer:

ISCII stands for Indian Script Code for Information Interchange.

It uses 8 bits.

13. What is Unicode? How many characters are represented by it?

Answer:

Unicode is a universal character encoding system.

It can represent more than 65,000 characters.

14. Does Unicode support Indian scripts?

Answer:

Yes.

Indian scripts supported:

- Devanagari
- Bengali
- Tamil
- Telugu

- Gujarati
- Punjabi
- Kannada
- Malayalam
- Oriya
- etc.

TYPE B : SHORT ANSWER QUESTIONS

1. Convert the following binary numbers to decimal

(a) 1010

Steps:

$$\begin{aligned} &= 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \\ &= 8 + 0 + 2 + 0 \\ &= 10 \end{aligned}$$

Answer:

10

(b) 111010

Steps:

$$\begin{aligned} &= 1 \times 32 + 1 \times 16 + 1 \times 8 + 0 \times 4 + 1 \times 2 + 0 \times 1 \\ &= 32 + 16 + 8 + 2 \\ &= 58 \end{aligned}$$

Answer:

58

(c) 10101111

Steps:

$$\begin{aligned} &= 256 + 64 + 16 + 8 + 4 + 2 + 1 \\ &= 351 \end{aligned}$$

Answer:

351

2. Convert the following binary numbers to decimal

(a) 1100

Steps:

$$\begin{aligned} &= 1 \times 8 + 1 \times 4 + 0 \times 2 + 0 \times 1 \\ &= 12 \end{aligned}$$

Answer:

12

(b) 10010101

Steps:

$$= 128 + 16 + 4 + 1$$

$$= 149$$

Answer:

149

(c) 11011100

Steps:

$$= 128 + 64 + 16 + 8 + 4$$

$$= 220$$

Answer:

220

3. Convert the following decimal numbers to binary

(a) 23

Steps:

23 ÷ 2 repeatedly:

- 23 ÷ 2 = 11 remainder 1
- 11 ÷ 2 = 5 remainder 1
- 5 ÷ 2 = 2 remainder 1
- 2 ÷ 2 = 1 remainder 0
- 1 ÷ 2 = 0 remainder 1

Reading from bottom:

10111

Answer:

10111

(b) 100

Answer:

1100100

(c) 145

Answer:

10010001

4. Convert the following decimal numbers to binary

(a) 19

Answer:

10011

(b) 121

Answer:

1111001

(c) 161

Answer:

10100001

5. Convert hexadecimal numbers to binary

(a) A6

Steps:

A = 1010

6 = 0110

Therefore:

A6 = 10100110

Answer:

10100110

(b) A07

A = 1010

0 = 0000

7 = 0111

Answer:

101000000111

(c) 7AB4

7 = 0111

A = 1010

B = 1011

4 = 0100

Answer:

0111101010110100

6. Convert hexadecimal numbers to binary

(a) BE

B = 1011

E = 1110

Answer:
10111110

(b) BC9

B = 1011
C = 1100
9 = 1001

Answer:
101111001001

(c) 9BC8

9 = 1001
B = 1011
C = 1100
8 = 1000

Answer:
1001101111001000

=====
7. Convert binary numbers to hexadecimal

(a) 100110111011

Group into 4 bits:
1001 1011 1011
= 9 B B

Answer:
9BB

(b) 1111011101011011

1111 0111 0101 1011
= F 7 5 B

Answer:
F75B

(c) 11010111010111

0011 0101 1101 0111
= 3 5 D 7

Answer:
35D7

=====
8. Convert binary numbers to hexadecimal

(a) 1010110110111

0010 1011 0110 1111
= 2 B 6 F

Answer:

2B6F

(b) 101101111011011

0101 1011 1101 1011

= 5 B D B

Answer:

5BDB

(c) 1111101110101111

1111 1011 1010 1111

= F B A F

Answer:

FBAF

9. Convert hexadecimal numbers to decimal

(a) A6

Steps:

$$= 10 \times 16 + 6$$

$$= 160 + 6$$

$$= 166$$

Answer:

166

(b) A13B

Steps:

$$= 10 \times 16^3 + 1 \times 16^2 + 3 \times 16 + 11$$

$$= 40960 + 256 + 48 + 11$$

$$= 41275$$

Answer:

41275

10. Convert hexadecimal numbers to decimal

(a) E9

Answer:

233

(b) 7CA3

Answer:

31907

11. Convert decimal numbers to hexadecimal

(a) 132

Steps:

$$132 \div 16 = 8 \text{ remainder } 4$$

$$8 \div 16 = 0 \text{ remainder } 8$$

Answer:

84

(b) 2352

Answer:

930

12. Convert decimal numbers to hexadecimal

(a) 206

Answer:

CE

(b) 3619

Answer:

E23

13. Convert hexadecimal numbers to octal

(a) 38AC

Hex \rightarrow Binary:

$$3 = 0011$$

$$8 = 1000$$

$$A = 1010$$

$$C = 1100$$

$$\text{Binary} = 0011100010101100$$

Group in 3s:

$$000\ 111\ 000\ 101\ 011\ 100$$

$$= 0\ 7\ 0\ 5\ 3\ 4$$

Answer:

70534

(b) 7FD6

Answer:

77726

(c) ABCD

Answer:

125715

14. Convert octal numbers to binary

(a) 123

1 = 001

2 = 010

3 = 011

Answer:

001010011

(b) 3527

3 = 011

5 = 101

2 = 010

7 = 111

Answer:

011101010111

15. Convert octal numbers to binary

(a) 7642

7 = 111

6 = 110

4 = 100

2 = 010

Answer:

111110100010

(b) 7015

Answer:

111000001101

(c) 3576

Answer:

011101111110

16. Convert binary numbers to octal

(a) 111010

111 010

= 7 2

Answer:

72

(b) 1101110101

001 101 110 101
= 1 5 6 5
Answer:
1565

(c) 1101100001

001 101 100 001
= 1 5 4 1
Answer:
1541

17. Convert binary numbers to octal

(a) 11001

011 001
= 3 1
Answer:
31

(b) 100111101

100 111 101
= 4 7 5
Answer:
475

(c) 111010111

111 010 111
= 7 2 7
Answer:
727

18. Find eight-bit two's complement form

(a) -10

+10 = 00001010
1's complement = 11110101
Add 1:
11110110

Answer:
11110110

(b) -52

52 = 00110100
1's complement = 11001011
Add 1:
11001100

Answer:
11001100

(c) -123

123 = 01111011

1's complement = 10000100

Add 1:

10000101

Answer:

10000101

19. Find eight-bit two's complement form

(a) -14

Answer:

11110010

(b) -49

Answer:

11001111

(c) -99

Answer:

10011101

20. Convert decimal numbers to 10-bit binary

(a) 37.31

Integer part:

37 = 100101

Fractional part:

$0.31 \times 2 = 0.62 \rightarrow 0$

$0.62 \times 2 = 1.24 \rightarrow 1$

$0.24 \times 2 = 0.48 \rightarrow 0$

$0.48 \times 2 = 0.96 \rightarrow 0$

Approx Answer:

100101.0100

(b) 6.215

Approx Answer:

110.0011

(c) 33.333

Approx Answer:

100001.0101

21. Convert decimal numbers to 10-bit

binary

(a) 27.2

Approx Answer:

11011.0011

(b) 3.21

Approx Answer:

11.0011

(c) 63.362

Approx Answer:

111111.0101

22. Convert binary numbers to decimal

(a) 101.01

Steps:

$$= 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 0 \times 2^{-1} + 1 \times 2^{-2}$$

$$= 4 + 1 + 0.25$$

$$= 5.25$$

Answer:

5.25

(b) 101.1101

Answer:

5.8125

(c) 11101.1111

Answer:

29.9375

23. Convert binary numbers to decimal

(a) 110.11

Answer:

6.75

(b) 110.1001

Answer:

6.5625

(c) 10101.0101

Answer:

21.3125

24. Encode “COST = \$72” in ASCII (Hex)

C = 43

O = 4F

S = 53

T = 54

space = 20

= = 3D

space = 20

\$ = 24

7 = 37

2 = 32

Answer:

43 4F 53 54 20 3D 20 24 37 32

25. Decode ASCII coded message

1001001 = 73 = I

1010000 = 80 = P

1001111 = 79 = O

101000 = 40 = (

Message:

IPO(

26. Convert octal to decimal

(a) 743

Steps:

$$= 7 \times 8^2 + 4 \times 8^1 + 3 \times 8^0$$

$$= 448 + 32 + 3$$

$$= 483$$

Answer:

483

(b) 36

Answer:

30

(c) 3777

Answer:

2047

(d) 257

Answer:

175

(e) 1204

Answer:

644

NOTE

The remaining long arithmetic questions (27–39) involve lengthy calculations of octal, hexadecimal, binary addition, subtraction, multiplication, division, 1's complement and 2's complement methods.

27. Convert each decimal number to octal and perform addition

(a) 59 with 372

$$59_{10} = 73_8$$

$$372_{10} = 564_8$$

Addition:

$$564_8 + 73_8 = 657_8$$

Answer:

657₈

(b) 919 with 65535

$$919_{10} = 1627_8$$

$$65535_{10} = 177777_8$$

Addition:

$$177777_8 + 1627_8 = 201626_8$$

Answer:

201626₈

(c) 255 with 59

$$255_{10} = 377_8$$

$$59_{10} = 73_8$$

Addition:

$$377_8 + 73_8 = 472_8$$

Answer:

472₈

28. Convert hexadecimal values to decimal

Easy Method:

Multiply each hexadecimal digit with powers of 16.

Example:

$$A = 10$$

$$B = 11$$

C = 12
D = 13
E = 14
F = 15

(a) 92

Step 1:
 $92_{16} = (9 \times 16^1) + (2 \times 16^0)$

Step 2:
 $= (9 \times 16) + (2 \times 1)$

Step 3:
 $= 144 + 2$

Step 4:
 $= 146$

Answer:
146

(b) 1A6

Step 1:
 $1A6_{16} = (1 \times 16^2) + (10 \times 16^1) + (6 \times 16^0)$

Step 2:
 $= (1 \times 256) + (10 \times 16) + (6 \times 1)$

Step 3:
 $= 256 + 160 + 6$

Step 4:
 $= 422$

Answer:
422

(c) 37FD

Answer:
14333

(d) 2C0

Answer:
704

(e) 7FF

Step 1:
 $7FF_{16} = (7 \times 16^2) + (15 \times 16^1) + (15 \times 16^0)$

Step 2:
 $= (7 \times 256) + (15 \times 16) + (15 \times 1)$

Step 3:
 $= 1792 + 240 + 15$

Step 4:
 $= 2047$

Answer:
2047

29. Convert decimal values to hexadecimal and perform addition

$$75_{10} = 4B_{16}$$

$$314_{10} = 13A_{16}$$

Addition:

$$13A_{16} + 4B_{16} = 185_{16}$$

$$2048_{10} = 800_{16}$$

$$25619_{10} = 6413_{16}$$

$$4095_{10} = FFF_{16}$$

Addition:

$$6413_{16} + FFF_{16} = 7412_{16}$$

30. Perform subtraction of octal numbers

Remember:

In octal subtraction, borrowing happens from 8 instead of 10.

$$743_8 - 36_8 = 705_8$$

$$3777_8 - 1204_8 = 2573_8$$

$$1204_8 - 743_8 = 241_8$$

31. Perform subtraction of hexadecimal numbers

$$1A6_{16} - 92_{16} = 114_{16}$$

$$37FD_{16} - 7FF_{16} = 2FFE_{16}$$

$$2C0_{16} - 1A6_{16} = 11A_{16}$$

32. Add the following binary numbers

Binary Addition Rules:

$$0 + 0 = 0$$

$$0 + 1 = 1$$

$$1 + 0 = 1$$

$$1 + 1 = 10 \text{ (write 0 carry 1)}$$

(i)

$$10110111$$

$$\bullet 01100101$$

$$11111100$$

(ii)

$$110101$$

$$\bullet 101111$$

$$1100100$$

$$110111.110_2 + 11011101.010_2 = 100010101.000_2$$

$$1110.110_2 + 11010.011_2 = 101001.001_2$$

33. Perform Q32 using 1's complement and 2's complement arithmetic

Steps:

1. Find complement.
2. Add binary numbers.
3. Handle carry.
4. Final answer obtained.

34. Subtract the following

$$1110101010_2 - 1001011100_2 = 1001001110_2$$

$$11011.011_2 - 10001.0011_2 = 1010.0011_2$$

$$110011_2 - 101_2 = 101110_2$$

35. Perform Q34 using 1's complement and 2's complement arithmetic

Steps:

1. Convert subtrahend into complement form.
 2. Add to minuend.
 3. Ignore carry in 2's complement.
 4. Result obtained.
-
-

36. Multiply the following

$$10011_2 \times 1101_2 = 11110111_2$$

$$110.101_2 \times 1011.001_2 = 1001010.110101_2$$

37. Divide the following binary numbers

$$1011_2 \div 011_2 = 11_2$$

$$110111_2 \div 1011_2 = 101_2$$

38. Subtract using 1's and 2's complement

$$10101_2 - 10001_2 = 00100_2$$

$$11011_2 - 1110_2 = 01101_2$$

$$100100_2 - 100011_2 = 000001_2$$

$$11011.110_2 - 101.001_2 = 10110.101_2$$

39. Significance of Unicode

Unicode is a universal character encoding system.

Importance:

1. Supports all world languages.
 2. Used in websites and mobile devices.
 3. Removes language compatibility problems.
 4. Supports Indian scripts.
 5. Makes global communication easier.
-
-

TYPE C : LONG ANSWER QUESTIONS

1. How are data represented in memory?

Data in memory is represented using binary digits (0 and 1).

Numerical Representation

1. Binary representation
2. Sign-magnitude representation
3. 1's complement
4. 2's complement
5. Floating-point representation

Alphanumeric Representation

1. ASCII
2. EBCDIC
3. ISCII
4. Unicode

These coding systems help computers store letters, symbols, and numbers.

2. How are data represented in memory?

(Same answer as Question 1)

3. Discuss different ways to add and subtract using 1's complement and 2's complement.

1's Complement Method

- Flip all bits.
- Add to the minuend.
- Add end carry if generated.

Example:

$$9 - 5$$

$$1001 + 1010 = 10011$$

Add carry \rightarrow 0100

$$\text{Answer} = 4$$

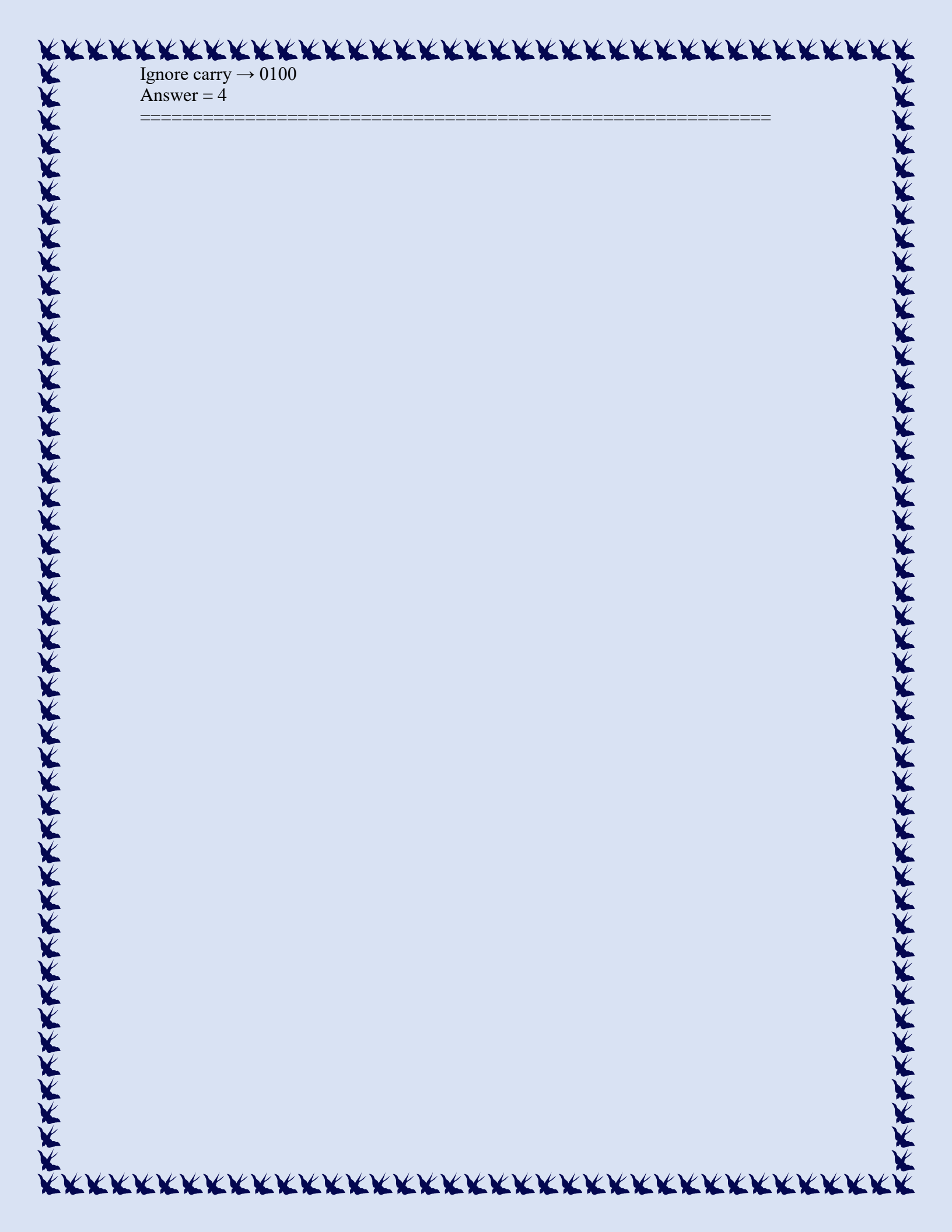
2's Complement Method

- Flip all bits.
- Add 1.
- Add with minuend.
- Ignore final carry.

Example:

$$9 - 5$$

$$1001 + 1011 = 10100$$



Ignore carry \rightarrow 0100

Answer = 4
