Encoding Schemes and Number System

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. Standard ASCII uses how many bits for each character?
(a) 16 **(b)** 32 **(c)** 8 **(d)** 7

2. What is $(111011000)_2$ in decimal?
(a) 472 **(b)** 464 **(c)** 456 **(d)** 55

3. What is $(212)_{10}$ in binary?
(a) 11010010 **(b)** 11011100 **(c)** 11010101 **(d)** 11010100

4. What is $(866)_{10}$ in octal?
(a) 1542 **(b)** 1543 **(c)** 1642 **(d)** 2542

5. What is $(891)_{10}$ in hexadecimal?
(a) 38B **(b)** B73 **(c)** 27B **(d)** 37B

6. What is $(110110000)_2$ in hexadecimal?
(a) 1B0 **(b)** 1A0 **(c)** 660 **(d)** 1C0

7. The ASCII code of 'A' is 65. What is the ASCII code of 'X'?
(a) 87 **(b)** 88 **(c)** 89 **(d)** 120

8. What is $(1101.101)_2$ in decimal?
(a) 13.625 **(b)** 13.5 **(c)** 6.8125 **(d)** 14.625

Section B — Short answer — 8 × 2 = 16 marks

9. Why do computers use the binary number system?

10. Convert $(894)_{10}$ into binary.

11. Convert into decimal: (a) $(11101000)_2$ (b) $(100110001)_2$

12. (a) Convert $(3893)_{10}$ into hexadecimal. (b) Convert $(80E)_{16}$ into decimal.

13. (a) Convert $(432)_{8}$ into binary. (b) Convert $(100011101)_{2}$ into octal.

14. Convert $(52.5)_{10}$ into binary.

15. A message has 54 English letters and spaces and 11 Devanagari letters. In UTF-8 an English letter or space takes 1 byte and a Devanagari letter 3 bytes; in UTF-32 every character takes 4 bytes. How many bytes does the message take in (a) UTF-8 (b) UTF-32?

16. The ASCII code of 'A' is 65. Write the ASCII codes of the letters of BED, in order.

Section C — Word problems — 4 × 4 = 16 marks

17. Explain ASCII, ISCII and Unicode, comparing how many characters each can represent.

18. Convert $(4043)_{10}$ into (a) binary (b) octal (c) hexadecimal.

19. Convert $(10111100.101)_{2}$ into (a) decimal (b) octal (c) hexadecimal.

20. Write these in decimal: (a) $(11010011)_2$ (b) $(42)_{16}$ (c) $(337)_8$. (d) Which is the largest of the three and $(199)_{10}$? Give its value in decimal.

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Answer key

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Q	Answer	Working
1	**(d) 7**	—
2	**(a) 472**	add the place values of the 1s
3	**(d) 11010100**	divide by 2 repeatedly and read the remainders from bottom to top
4	**(a) 1542**	divide by 8 repeatedly; remainders bottom to top
5	**(d) 37B**	divide by 16 repeatedly; 10 to 15 are A to F
6	**(a) 1B0**	group the bits in fours from the right
7	**(b) 88**	'X' is 23 letters after 'A'
8	**(a) 13.625**	after the point the places are 1/2, 1/4, 1/8: 13 + 5/8
9	**Their circuits have two states, on and off, which stand for 1 and 0.**	—
10	**1101111110**	remainders of repeated division by 2, read from bottom to top
11	**(a) 232; (b) 305**	add the place values of the 1s
12	**(a) F35; (b) 2062**	divide by 16; multiply by powers of 16
13	**(a) 100011010; (b) 435**	each octal digit is three bits
14	**110100.1**	integer part by dividing by 2; fraction part by multiplying by 2 until it becomes 0
15	**(a) 87 bytes; (b) 260 bytes**	54 + 3 × 11; 4 × 65
16	**66, 69, 68**	A = 65, B = 66, …
17	**ASCII: 7 bits, 128 characters (English); ISCII: 8 bits, adds Indian scripts; Unicode: codes for every script, stored as UTF-8, UTF-16 or UTF-32.**	—
18	**(a) 111111001011; (b) 7713; (c) FCB**	binary 111111001011; group in threes for octal, fours for hexadecimal
19	**(a) 188.625; (b) 274.5; (c) BC.A**	188 + 5/8; octal: groups of three on each side of the point; hexadecimal: groups of four, padding the fraction with a 0 (1010)
20	**(a) 211; (b) 66; (c) 223; (d) 223**	convert each to decimal, then compare