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CS260 Assignment 17

Question 1

Total characters: 100

Total bits: 100 \* 8 = 800 bits

Question 2

Question 3

Question 4

Question 5

Question 6

Question 7

Question 8

0

0

0

0

1

1

1

1

0

1

Question 9

|  |  |
| --- | --- |
| Letter | Code |
| a | 0000 |
| b | 0001 |
| c | 001 |
| d | 10 |
| e | 11 |
| f | 01 |

Question 10: Total letter = 100.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Letter | Percent | Code | Occurrences | Size |
| a | 7 | 0000 | 7 | 28 |
| b | 9 | 0001 | 9 | 36 |
| c | 12 | 001 | 12 | 36 |
| d | 22 | 10 | 22 | 44 |
| e | 23 | 11 | 23 | 46 |
| f | 27 | 01 | 27 | 54 |
| Total Size | | | | 244 |

Using Huffman encoding, only 244 bits needed. (800 bits originally)

Question 11

Compression Ratio = Uncompressed Size / Compressed Size = 800 / 244 = 3.2787

Question 12

1. M(1) = 1
2. M(2) = 2 \* M(2/2) + 2 = 2 \* M(1) + 2 = 2 \* 1 + 2 = 4
3. M(4) = 2 \* M (4/2) + 4 = 2 \* M(2) + 4 = 2\*4 + 4 = 12
4. M(8) = 2\*M(8/2) + 8 = 2\*M(4) + 8 = 2\*12 + 8 = 32

Question 13

M(n) = 2M(n/2) + n Iteration 1

= 2 [2M(n/4) + n/2] + n = 4M(n/4) + 2n Iteration 2

= 4[2M(n/8) + n/4] + 2n = 8M(n/8) + 3n Iteration 3

= 2k M(n/2k) + kn Iteration k

Question 14

It stops at T(1) so

M(1) = M(n/2k)

1 = n/2k

2k = n

k = log2(n)

Question 15

M(n) = 2k M(n/2k) + kn = nM(n/n) + nlog2(n) = nM(1) + nlog2(n) = n + nlog2(n)

Question 16

1. a = 9, b = 3 and f(n) = 4n
2. a = 1, b = 3 and f(n) = 9n3
3. a = 4, b = 2 and f(n) = n3
4. a = 25, b = 5 and f(n) = 10n
5. a = 1, b = 2 and f(n) = n

Compute c

1. c = log3(9) = 2
2. c = log3(1) = 0
3. c = log2(4) = 2
4. c = log5(25) = 2
5. c = log2(1) = 0

Question 17

1. c = 2, f(n) = 4n. We find that 4n = O(n2 - e) where e = 1. So Case 1 selected, T(n) = Θ(n2)
2. c = 0, f(n) = 9n3. We find that 9n3 = Ω(n0 + e) where e = 3. So Case 3 selected, T(n) = Θ(n3)
3. c = 2, f(n) = n3. We find that n3 = Ω(n2 + e) where e = 1. So Case 3 selected, T(n) = Θ(n3)
4. c = 2, f(n) = 10n. We find that 10n = O(n2 - e) where e = 1. So Case 1 selected, T(n) = Θ(n2)
5. c = 0, f(n) = n. We find that n = Ω(n0 + e) where e = 1. So Case 3 selected, T(n) = Θ(n)

Question 18

1. a = 25, b= 5, so c = log5(25) = 2 and f(n) = n2log23(n). Because n2log23(n) = Θ(n2log3(n)), so case 2 selected, k = 3. T(n) = Θ(n2log4n)
2. a = 81, b = 9, so c = log9(81) = 2 and f(n) = n2. Because n2 = Θ(n2log0n), so case 2 selected, k = 0. T(n) = Θ(n2logn)