

## Compiled Solutions – Junior Division

### 1. 02-03 C1 Computer Number Systems

$$\begin{array}{r} 1074_8 = 1000111100_2 \\ 213_{16} = 1000010011_2 \\ \hline 10001001111_2 \end{array}$$

### 2. 02-03 C1 Computer Number Systems

Converting the problem to an equation produces:  $4CE_{16}$

$$\begin{aligned} X_{16} + 64_{16} &= 532_{16} \\ X_{16} &= 532_{16} - 64_{16} \\ X_{16} &= 4CE_{16} \end{aligned}$$

### 3. 03-04 C1 Computer Number Systems

A.  $42_8 = 100010$       B.  $3A_{16} = 111010$       B, C, and D  
C.  $92_{10} = 1011100$       D.  $1011_2 = 1011$   
E.  $214_8 = 10001100$

### 4. 03-04 C1 Computer Number Systems

$$X_{16} = 11_2 + 26_8 - 15_{10} = 11_2 + 10110_2 - 1111_2 = 1010_2 = A_{16}$$

### 5. 04-05 C1 Computer Number Systems

$$343_8 = E3_{16} \text{ and } 11101101_2 = ED_{16}$$

A) 11101101<sub>2</sub>  
B) A<sub>16</sub>

### 6. 04-05 C1 Computer Number Systems

$$B2A3_{16} = 1\ 011\ 001\ 010\ 100\ 011_2 = 131243_8$$

### 7. 05-06 C1 Computer Number Systems

$$473_8 = 1\ 0011\ 1011_2 = 1\ 3\ B_{16}$$

### 8. 05-06 C1 Computer Number Systems

$$\begin{aligned} 2F3_{16} &= 1011110011 \Rightarrow 7\ 1\text{'s} \\ 6E_{16} &= 101101110 \Rightarrow 6\ 1\text{'s} \end{aligned}$$

### 9. 06-07 C1 Computer Number Systems

$$X_{16} = 1101101010_2 - 100101_2 = 11\ 0100\ 0101_2 = 345_{16} \qquad 345_{16}$$

### 10. 06-07 C1 Computer Number Systems

$$\text{A) } 52_{16} = 82 \quad \text{B) } 124_8 = 84 \quad \text{C) } 83_{10} = 83 \quad \text{D) } 1010001_2 = 81 \qquad \text{D,A,C,B}$$

### 11. 07-08 C1 Computer Number Systems

Convert to binary, then group by threes to produce octal digits. 521664<sub>8</sub>

$$\begin{aligned} 2A3B4_{16} &= 10\ 1010\ 0011\ 1011\ 0100_2 \\ &= 101\ 010\ 001\ 110\ 110\ 100_2 \\ &= 5\ 2\ 1\ 6\ 6\ 4 \end{aligned}$$

### 12. 07-08 C1 Computer Number Systems

$$\begin{aligned} 206_8 = 134 & \qquad 1111111_2 = 127 & \qquad 1001_2 \\ 84_{16} = 132 & \qquad 125_{10} = 125 \\ \text{So } 134 - 125 &= 9_{10} = 1001_2 \end{aligned}$$

### 13. 08-09 C1 Computer Number Systems

Converting to decimal: 44<sub>16</sub>

$$76_8 = 62, \ 111100_2 = 60, \ 44_{16} = 68, \ 101_8 = 65, \ 61_{10} = 61$$

The largest number is  $44_{16} = 68$ .

### 14. 08-09 C1 Computer Number Systems

Adding vertically in hex yields a sum of 13870 in hex. 13870<sub>16</sub>

Converting each number to decimal the addends become

$$66111 + 11418 + 2228 + 213 + 14 = 79984 \text{ which is } 13870_{16}$$

### 15. 09-10 C1 Computer Number Systems

$$\begin{aligned} 234_{16} &= 001000110100_2 & 4\ 1\text{'s} & \quad A7_{16} = 10100111_2 & 5\ 1\text{'s} & \qquad 7E_{16} \\ 7E_{16} &= 01111110_2 & 6\ 1\text{'s} & \quad 78_{16} = 01111000_2 & 4\ 1\text{'s} & \\ AB_{16} &= 10101011_2 & 5\ 1\text{'s} & \quad \therefore 7E_{16} & \text{ has the most } 1\text{'s} & \end{aligned}$$

### 16. 09-10 C1 Computer Number Systems

$$\begin{aligned} 44_{16} = 68, \ 222_8 = 146, \ 1111_2 = 15, \ 8_{16} = 8, \ 44_8 = 36, \ 111_2 = 7 & \qquad B2_{16} \\ \text{So } 44_{16} + 222_8 + 1111_2 - 8_{16} - 44_8 - 111_2 & \text{ becomes} \\ 68 + 146 + 15 - 8 - 36 - 7 = 178 = B2_{16} & \end{aligned}$$

### 17. 10-11 C1 Computer Number Systems

$$\begin{aligned} A2C3E5_{16} &= 1010\ 0010\ 1100\ 0011\ 1110\ 0101_2 && 50541745_8 \\ &= 101\ 000\ 101\ 100\ 001\ 111\ 100\ 101_2 \\ &= 50541745_8 \end{aligned}$$

### 18. 10-11 C1 Computer Number Systems

Converting each to decimal: 71<sub>8</sub>

$$34_{16} = 52, 63_8 = 51, 110110_2 = 54, 71_8 = 57, 56_{10} = 56$$

### 19. 11-12 C1 Computer Number Systems

Convert each to base 10: A8<sub>16</sub>

$$\begin{aligned} 243_8 &= 2 * 64 + 4 * 8 + 3 = 163 \\ 10100110_2 &= 128 + 32 + 4 + 2 = 166 \\ A8_{16} &= 10 * 16 + 8 = 168 \\ 165_{10} &= 165 \end{aligned}$$

### 20. 11-12 C1 Computer Number Systems

$$\begin{aligned} 4273_8 &= 100\ 010\ 111\ 011_2 && 8BB_{16} \\ &= 1000\ 1011\ 1011_2 \\ &= 8\ B\ B_{16} \end{aligned}$$

### 21. 12-13 C1 Computer Number Systems

It is easier to do the calculations in hex. From right to left, borrowing when necessary yields: 31C2<sub>16</sub>

$$\begin{aligned} F - D &= 2 \\ 1A - E &= C \\ D - C &= 1 \\ D - A &= 3 \end{aligned}$$

### 22. 12-13 C1 Computer Number Systems

$$\begin{aligned} FACE_{16} &= 1111\ 1010\ 1100\ 1110_2 && 175316_8 \\ &= 1\ 111\ 101\ 011\ 001\ 110_2 \\ &= 1\ 7\ 5\ 3\ 1\ 6_8 \end{aligned}$$

### 23. 13-14 C1 Computer Number Systems

Converting each to base 10: 10F<sub>16</sub>  
F<sub>16</sub> = 241  
375<sub>8</sub> = 253  
10F<sub>16</sub> = 271  
264<sub>10</sub> = 264  
11111000<sub>2</sub> = 248      Therefore 10F<sub>16</sub> is the largest.

### 24. 13-14 C1 Computer Number Systems

Convert first to decimal: 101<sub>2</sub> \* 3<sub>10</sub> + 11<sub>16</sub> - 52<sub>8</sub> / 6<sub>10</sub> 11001<sub>2</sub>  
= 5 \* 3 + 17 - 42 / 6  
= 15 + 17 - 7 = 25 = 11001<sub>2</sub>

### 25. 14-15 C1 Computer Number Systems

2471<sub>8</sub> = 010100111001      6 1's 2471<sub>8</sub>  
A62<sub>16</sub> = 101001100010      5 1's  
1010101010<sub>2</sub>      5 1's  
452<sub>10</sub> = 111000100      4 1's

### 26. 14-15 C1 Computer Number Systems

Convert first to decimal: (23<sub>8</sub> + A3<sub>16</sub>) / 2<sub>10</sub> 5B<sub>16</sub>  
= (19 + 163) / 2  
= 182 / 2  
= 91 = 5B<sub>16</sub>

### 27. 15-16 C1 Computer Number Systems

414<sub>8</sub> = 100001100<sub>2</sub>      3 1's 1B5<sub>16</sub>  
1B5<sub>16</sub> = 110110101<sub>2</sub>      6 1's  
178<sub>10</sub> = 10110010<sub>2</sub>      4 1's  
200<sub>16</sub> = 100000000<sub>2</sub>      1 1  
600<sub>8</sub> = 110000000<sub>2</sub>      2 1's

### 28. 15-16 C1 Computer Number Systems

(743<sub>8</sub> - AF<sub>16</sub> + 110100101000<sub>2</sub>) \* 256<sub>10</sub> 7  
= (111100011<sub>2</sub> - 10101111<sub>2</sub> + 110100101000<sub>2</sub>) \* 10000000<sub>2</sub>  
= 111001011100<sub>2</sub> \* 10000000<sub>2</sub>  
= 111001011100000000<sub>2</sub>      That's 7 1's.