Examples 2 in The Radix

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Convert the number on the base indicated inside the square brackets into the decimal equivalent.

Examples: $10_{[3]} = 3_{[10]} = 3$, $21_{[4]} = 9$, $32_{[5]} = 17$, and $123_{[4]} = 27$

0. $23_{[4]}$ **1**. $1101_{[2]}$ **2**. $403_{[5]}$

3. $435_{[6]}$ **4**. $87_{[9]}$ **5**. $10101_{[2]}$

6. $572_{[8]}$ **7**. $11111_{[2]}$ **8**. $10101_{[7]}$

9. $B3AB_{[12]}$ **A**. $A80BC_{[14]}$ **B**. $CB2A0D_{[16]}$

C. $9D0AG_{[17]}$ **D.** $H0D32K_{[24]}$

Suggestions or Solutions

To the Problem 0

$23_{[4]}$

We want to convert 23 on the base 4 to a decimal equivalent. Equivalent numbers can look different, but specify the same value.

23 is on the base 4. So **2**3 has **2** of 4s and **3** of 1s.
And 2 of 4s = 2 x 4 = 8 = 8 x 1 = 8 of 1s.
Thus, 23 has 11 of 1s.
We know 11 of 1s = 11 x 1 = 11 on the base 10, of course.
Therefore, $23_4 = 2 \times 4 + 1 \times 3 = 8 + 3 = 11$.

Suggestions or Solutions
To the Problem 1

$1101_{[2]}$

1101 is on the base 2.
How many of 1s does 1101 on the base 2 have?

We can break the number apart the way as follows.

1101 on the base 2 has 1 of (2 x 2 x 2)s, 1 of (2 x 2)s, and 1 of 1s. And we have 1 x (2 x 2 x 2) = 1 x 8 = 8,
1 x (2 x 2) = 1 x 4 = 4, and1 x 1 = 1

So 1101 on the base 2 has (8 + 4 + 1) of 1s, which is 13 of 1s. We know 13 of 1s = 13 x 1 = 13, which is decimal, of course.

$1101_{[2]}$ = 1 x 2 x 2 x 2 + 1 x 2 x 2 + 0 x 2 + 1
= 1 x 2^3 + 1 x 2^2 + 0 x 2^1 + 1 = 8 + 4 + 0 + 1 = 13

We don’t usually use the subscript for a decimal number.

Suggestions or Solutions
To the Problem 2

2. $403_{[5]}$

403 is on the base 5, so each unit is a set of 5 equal pieces.
And 403 has 4 of (5 x 5)s and 3 of 1s.

$403_{[5]}$
$= 4 \times 5 \times 5 + 0 \times 5 + 3 \times 1$
$= 4 \times 5^2 + 0 \times 5^1 + 3 \times 5^0$
$= 4 \times 25 + 3$
$= 103$

Suggestions or Solutions
To the Problem 3

$435_{[6]}$

435 on the base 6 has 4 of (6 x 6)s, 3 of 6s, and 5 of 1s.

$435_{[6]}$

$= 4 \times 6 \times 6 + 3 \times 6 + 5 \times 1$

$= 4 \times 6^2 + 3 \times 6^1 + 5 \times 6^0$

$= 4 \times 36 + 18 + 5$

$= 120 + 24 + 18 + 5$

$= 150 + 17$

$= 167$

Suggestions or Solutions
To the Problem 4

$87_{[9]}$

87 on the base 9 has 8 of 9s and 7 of 1s.

$87_{[9]}$

$= 8 \times 9 + 7 \times 1$

$= 8 \times 9^1 + 7 \times 9^0$

$= 72 + 7$

$= 79$

Suggestions or Solutions

To the Problem 5

$10101_{[2]}$

$10101_{[2]}$

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

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

$= 16 + 0 + 4 + 0 + 1$

$= 21$

Suggestions or Solutions

To the Problem 6

$572_{[8]}$

$572_{[8]} = 5 \times 8^2 + 7 \times 8^1 + 2 \times 8^0 = 320 + 56 + 2 = 378$

Suggestions or Solutions

To the Problem 7

7. $11111_{[2]}$

$11111_{[2]} = 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$= 16 + 8 + 4 + 2 + 1 = 16 + 4 + 8 + 2 + 1 = 31$

Suggestions or Solutions
To the Problem 8

$10101_{[7]}$

$10101_{[7]} = 1 \times 7^4 + 0 \times 7^3 + 1 \times 7^2 + 0 \times 7^1 + 1 \times 7^0$

$= 7^4 + 7^2 + 1$

$= 7 \times 7 \times 7 \times 7 + 7 \times 7 + 1$

$= (7 \times 7) \times (7 \times 7) + 7 \times 7 + 1$

$= 49 \times 49 + 49 + 1$

$= 49 \times (49 + 1) + 1$

$= 49 \times 50 + 1$

$= 49 \times (100/2) + 1$

$= 4900/2 + 1$

$= 2450 + 1$

$= 2451$

Suggestions or Solutions

To the Problem 9

$B3AB_{[12]}$

$B3AB_{[12]}$

$= B \times 12^3 + 3 \times 12^2 + A \times 12^1 + B \times 12^0$

$= 11 \times 12^3 + 3 \times 12^2 + 10 \times 12^1 + 11 \times 12^0$

$= 11 \times 1728 + 3 \times 144 + 120 + 11$

$= 19008 + 432 + 131$

$= 19563$

Suggestions or Solutions
To the Problem A

$A80BC_{[14]}$

$A80BC_{[14]}$

$= A \times 14^4 + 8 \times 14^3 + 0 \times 14^2 + B \times 14^1 + C \times 14^0$

$= 10 \times 38416 + 8 \times 2744 + 0 + 11 \times 14 + 12 \times 1$

$= 384160 + 21952 + 154 + 12$

$= 406278$

Suggestions or Solutions

To the Problem B

$CB2A0D_{[16]}$

$CB2A0D_{[16]}$

$= C \times 16^5 + B \times 16^4 + 2 \times 16^3 + A \times 16^2 + 0 \times 16^1 + D \times 16^0$

$= 12 \times 1048576 + 11 \times 65536 + 2 \times 4096 + 10 \times 256 + 0$

$+ 13 \times 1$

$= 12582912 + 720896 + 8192 + 2560 + 13$

$= 13414573$

Suggestions or Solutions
To the Problem C

$9D0AG_{[17]}$

$9D0AG_{[17]} = 9 \times 17^4 + D \times 17^3 + 0 \times 17^2 + A \times 17^1 + G \times 17^0$

$= 9 \times 83521 + 13 \times 4913 + 0 + 170 + 16 \times 1$

$= 751689 + 63869 + 170 + 16$

$= 815744$

Suggestions or Solutions
To the Problem D

$H0D32K_{[24]}$

$H0D32K_{[24]} = H \times 24^5 + 0 \times 24^4 + D \times 24^3 + 3 \times 24^2 + 2 \times 24^1 + K \times 24^0$

$= 17 \times 7962624 + 0 + 13 \times 13824 + 3 \times 576 + 48 + 20$

$= 135364608 + 179712 + 1728 + 68$

$= 135546096$