Unit 2 · Whole Numbers

HARDER PRACTICE QUESTIONS

Full marks 28

Write your answers on separate paper. Show your working. Write the base as a suffix on every binary and quinary number.

1 The missing digits [3]

i. Find the digit x if $2x3_5 = 73$.
ii. Find the digits a and b if $1a0b_2 = 13$.
iii. Can $1a0b_2$ ever be 11? Give a reason.

2 Put them in order [3]

Arrange 101101_2, 143_5 and 46 in ascending order. Then write the difference between the largest and the smallest in binary and in quinary.

3 One string of digits, two numbers [3]

The digits 1011 can be read in binary or in quinary.

i. Find the difference between 1011_5 and 1011_2, and write it in quinary.
ii. Whatever string of 0s and 1s you take, the quinary reading is never smaller than the binary reading. Why?

4 Spot the error [3]

Find the mistake and correct it.

Siddhanta changed 38 to binary. He divided by 2 again and again and got the remainders 0, 1, 1, 0, 0, 1 in that order, so he wrote $38 = 011001_2$. Then he checked his answer by changing it back to decimal.

What number did he get back? What is his mistake? What is the right answer?

5 Show it [3]

i. Change 1011_2 and 10110_2 to decimal, and change 23_5 and 230_5 to decimal. What does writing a 0 on the right do to the number in each system?
ii. Explain why, using place values.

6 How many digits? [4]

i. What are the largest and the smallest 4-digit quinary numbers, in decimal?
ii. How many 4-digit quinary numbers are there?
iii. How many digits has 1000 in binary? How many in quinary?
iv. Which needs more digits, a number in binary or the same number in quinary? Why?

7 In a real setting [4]

An imaginary country has only notes of 1, 5, 25 and 125 rupees, and you may use any number of each.

i. Change 389 to quinary.
ii. What do the digits of your answer tell you about paying 389 rupees?
iii. What is the fewest notes that make 389 rupees?
iv. Why does a person paying with the fewest notes never use five notes of one kind?

8 Think [3]

In binary, the last digit tells you whether a number is odd or even. In quinary it doesn't: 12_5 is 7, but 13_5 is 8 and 11_5 is 6.
Zeenat says: "A quinary number is even exactly when the sum of its digits is even." Test this on 1234_5, and explain why it always works.

9 Make your own [2]

Make a secret code. Number the letters A = 1, B = 2, … Z = 26 and write each letter as a 5-digit binary number (so C is 00011). Write a three-letter word in your code. Why are five digits enough for every letter, and four digits not?