Mr. Tinker Learns About the Mouse People

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"I don't see the point of all this polynomial business anyway," Mr. Tinker said. "It's not the sort of thing normal people have any need of."

"Every number is a polynomial, if you want to think of it that way," said the Lazy Man. [Actually, he was only thinking of the counting numbers.] For instance, take 31256. If you let

$$p(x) = 3x^4 + x^3 + 2x^2 + 5x + 6$$

then $31256 = p(10)$.

"You always work these things out to fast for me," said Mr. Tinker.

"But it's easy," the Lazy Man said, and explained why.

"Well, that's not really what you'd call useful."

"Ah, but suppose 31256 didn't really mean 31256 but instead was a number written in the base 8 [octal] system. Then we could still use the same polynomial and our answer would be $p(8)$."

"I guess I've forgotten about base 8 numbers. What are they for?"

"Well," said the Lazy Man, and stopped for a few minutes to light his pipe. "In the heart of darkest California there lives a lost race called the Mouse People. They worship a god named Disney and, the funny thing is, they only have four fingers on each hand. So when they count, they count

$$1, \ 2, \ 3, \ 4, \ 5, \ 6, \ 7, \ 10, \ 11, \ \ldots$$

In other words, when the Mouse People say 10 they really mean 8, and their counting goes on

$$\ldots, 67, \ 70. \ 71, \ \ldots, \ 77, \ 100.$$

In other words, when they say 100 they really mean ... WHAT?"

"I don't know," said Mr. Tinker.

The Lazy Man gave him a pitying look. "_____, of course! It's so obvious. Now when you write down one of their numbers, it's best if you write it like this: 31256_8. That keeps you from getting it confused with a number written in the ordinary decimal way. And if you want to change it so it's written in decimal, that's easy, using the polynomial trick."

1. Change the following numbers to base 10, using Horner's Method:

$$31256_8 \qquad 7245_8 \qquad 36_8 \qquad 124_8 \qquad 100402_8 \qquad 1000_8 \qquad 327_8.$$

"Well, at least we don't have to worry about changing the other way. From base 10 to base 8, I mean," Mr. Tinker said.

"Ah, but that's easy too. You just reverse the Horner's Method procedure you used to go from 8 to 10. You work from right to left and divide by 8 instead of multiplying. Put the original number at the right end of the top line, divide by 8 and put the quotient to the left of it, then multiply back again and put the remainder on the third line."

"I'm lost," said Mr. Tinker.

"Here, I'll show you. Let's start with 12974_{10}."

	202	1621	12974
		1616	12968
		5	6

"And then what?"

"Just keep doing the same thing until you get a number smaller than 8 on the top line. Copy that one down to the bottom and you're done." The Lazy Man finished the calculation. "Notice how the final calculation looks just like what we did when we changed 31256_8 to decimal, except upside down."

2. Finish the calculation above and then change the following numbers to octal:

$$14 \qquad 29 \qquad 40 \qquad 312 \qquad 3452 \qquad 1517 \qquad 258 \qquad 1000 \qquad 768.$$

"I'm not sure I believe in those Mouse people," Mr. Tinker said.

"Aha," said the Lazy Man. "Then let me tell you how computers are designed."

But Mr. Tinker remembered that he had an urgent appointment.