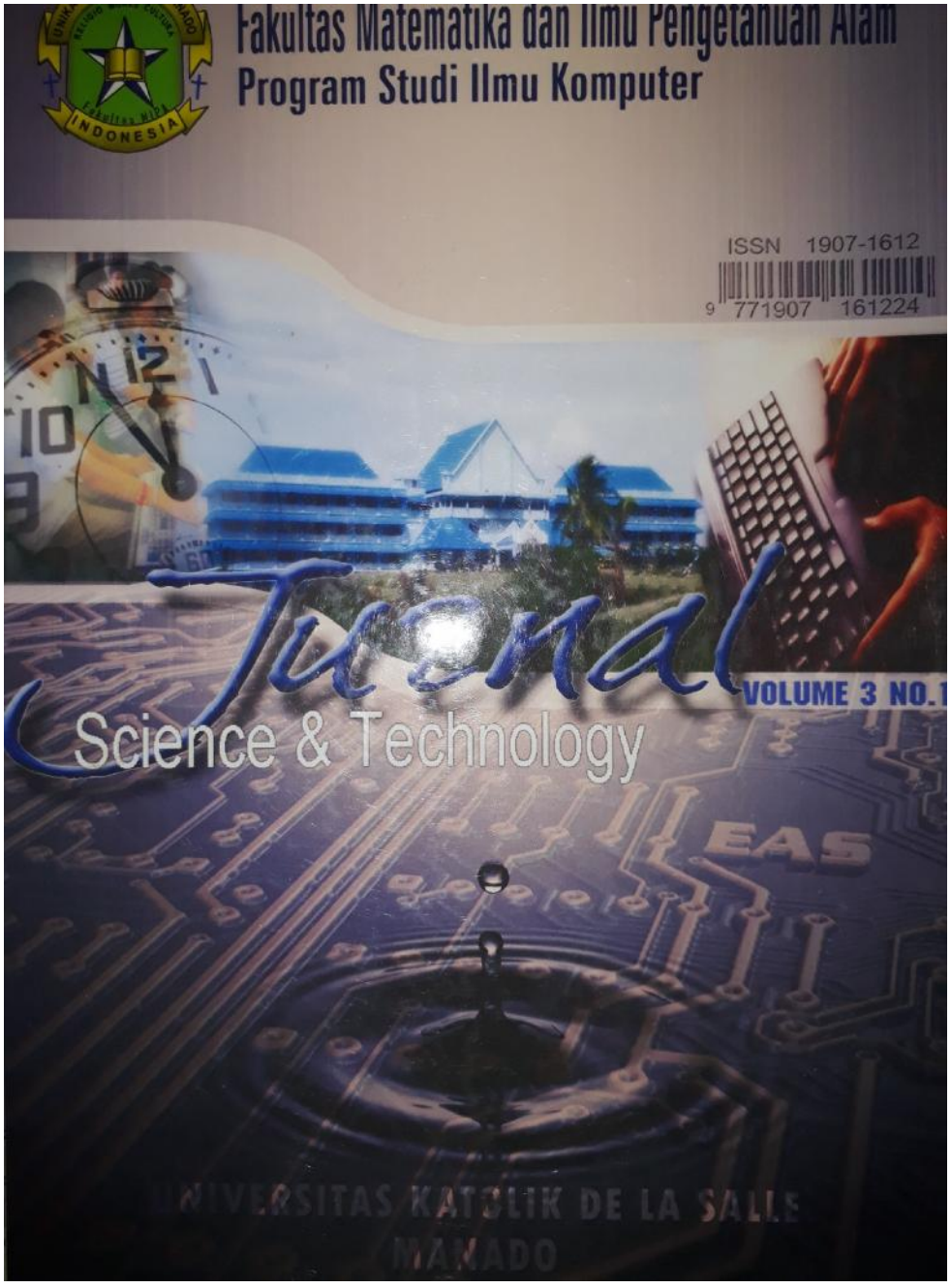
Fakultas Matematika dan Ilmu Pengetahuan Alam
Program Studi Ilmu Komputer
ISSN 1907-1612
9 771907 161224
Jurnal
VOLUME 3 NO.1
Science & Technology
UNIVERSITAS KATOLIK DE LA SALLE
MANADO

SCIENCE & TECHNOLOGY
Jurnal Ilmiah

Jurnal
Science & Technology

ISSN 1907-1612

Volume 3 Number 1
December 2008

Contents

THE CONVERSION OF DECIMAL-TO-OCTAL

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Abstrak

Disamping bilangan desimal kita juga mengenal bilangan oktal dan heksadesimal. Dalam banyak aplikasi, penggunaan bilangan oktal dan heksadesimal cukup penting sehingga perlunya pemahaman tentang cara mengkonversi bilangan desimal ke dalam oktal atau heksadesimal. Penulisan ini akan menjabarkan langkah-langkah dalam mengkonversi bilangan desimal ke bilangan oktal dengan mengikuti format yang sedikit berbeda.

Kata kunci: Konversi Desimal-Oktal, Sistem Bilangan

1 Introduction

Number system is the basic of digital system and also very useful for some other functions. Decimal, Binary, Octal, and Hexadecimal are the four important numbers that we usually learn in relation to that topic. Their importance in mathematics makes them also important to be converted each other.

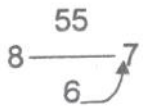
Decimal is a base-10 number and known as our daily life number. Octal is a base-8 number and used in minicomputers and many computer applications. We can convert decimal number to octal by making a division with eight as the base of octal (divide-by-8).

Let us review again the conversion method:

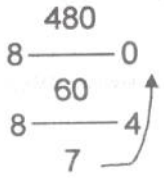
$$24 = 30_8$$

$$\begin{array}{r|l} 24 & \\ \hline 8 & 0 \\ 3 & \end{array}$$

$$55 = 67_8$$



$$480 = 740_8$$



It is the same method using in binary and hexadecimal. For octal, we use the number 8 as its base. Small numbers are easy to be converted, but large numbers need a little bit time to be solved and quite complex too.

2 Aims of Study

This paper will try to analyze some calculations of decimal-octal conversion, and show an alternative way of deriving the numeric value for that conversion. Hopefully, it will give a great contribution in digital science and technology, develop creative thinking, and help academic people to create good innovations for human life.

3 Research Method

Based on the conversion table of decimal-octal, making few assumptions and analysis, I will try to derive an alternative method to determine that conversion.

4 Discussion and Results

Using the conversion method that we have learned, we can build a conversion table for decimal-octal, started at number 10:

DECIMAL	OCTAL	DIFFERENCE
10	12	+2
11	13	+2
12	14	+2
13	15	+2
14	16	+2
15	17	+2
16	20	+4
17	21	+4
18	22	+4
19	23	+4
20	24	+4
21	25	+4
22	26	+4
23	27	+4
24	30	+6
25	31	+6
26	32	+6
27	33	+6
28	34	+6
29	35	+6
30	36	+6
40	50	+10
50	62	+12
51	63	+12
54	66	+12
57	71	+14
60	74	+14

This table showed that octal numbers increase according to its multiplicand.

1 x 8 = 8
2 x 8 = 16
3 x 8 = 24
4 x 8 = 32
5 x 8 = 40
6 x 8 = 48
7 x 8 = 56

- **8, + (1 x 2) = +2**
- **16, + (2 x 2) = +4**
- **24, + (3 x 2) = +6**
- **32, + (4 x 2) = +8**
- **40, + (5 x 2) = +10**
- **48, + (6 x 2) = +12**
- **56, + (7 x 2) = +14**

Is this assumption reliable for all decimal numbers?? Let's check again with bigger numbers.

DECIMAL	OCTAL	DIFFERENCE
64	100	+36
65	101	+36
78	116	+38
83	123	+40
99	143	+44
100	144	+44
120	170	+50
200	310	+110
250	372	+122

Our first assumption doesn't work for bigger numbers, started from 64. If we follow the assumption, the result that we will get is 64 + (8 x 2) = 64 + 16 = 80. It is wrong because the correct result is 100. Even though this assumption is right, this method is not applicable because we need to memorize the multiplication of 8, which of course need more time to think and do the analyse.

Now we will try to learn the table again and get an approach conclusion. Maybe we should start at number one:

DECIMAL	OCTAL	DIFFERENCE
1	1	**+0**
2	2	+0
3	3	+0
4	4	+0
5	5	+0
6	6	+0
7	7	+0
8	10	**+2**
9	11	+2
10	12	+2
11	13	+2
12	14	+2
13	15	+2
14	16	+2
15	17	+2
16	20	**+4**
17	21	+4
18	22	+4
19	23	+4
20	24	+4
21	25	+4
22	26	+4
23	27	+4
24	30	**+6**

We just memorize the octal of decimal 1 until 9. Then take the same approach like the first assumption, but we will use the multiplication of 2 with the first number digit.

$$\begin{array}{r} (1)0 \\ 2 \\ \hline 12 \end{array} + \qquad \begin{array}{r} (1)5 \\ 2 \\ \hline 17 \end{array} + \qquad \begin{array}{r} (1)6 \\ 2^* \\ \hline 20 \end{array} +$$

$$\begin{array}{r} (1)7 \\ 2^* \\ \hline 21 \end{array} + \qquad \begin{array}{r} (1)8 \\ 2^* \\ \hline 22 \end{array} + \qquad \begin{array}{r} (2)4 \\ 4^* \\ \hline 30 \end{array} +$$

$$\begin{aligned} *\ 6 + 2 &= 8 \ = 10 \\ 7 + 2 &= 9 \ = 11 \\ 8 + 2 &= 10 = 12 \\ 4 + 4 &= 8 \ = 10 \end{aligned}$$

The above method gives the exact values for octal numbers. How about bigger numbers? Let's calculate again using our second approach.

$$\begin{array}{r} (3)5 \\ 6 \\ \hline 43 \end{array} + \qquad \begin{array}{r} (4)2 \\ 8 \\ \hline 52 \end{array} + \qquad \begin{array}{r} (5)0 \\ 12 \\ \hline 62 \end{array} +$$

$$\begin{array}{r} (9)9 \\ 18 \\ 2 \\ \hline 143 \end{array} + \qquad \begin{array}{r} (10)0 \\ 20 \\ 24 \\ \hline 144 \end{array} + \qquad \begin{array}{r} (25)0 \\ 50 \\ 4 \\ 12 \\ \hline 372 \end{array} +$$

The result stays correct. It means that our second assumption is right. So this is the other way of solving decimal-octal number, and this method has been applied to number 10 until 999, and it works. Could we make a conversion of 1000, 2500, or 10000? Of course it needs a little complex calculation to solve them, but you can try to convert them using this method. If it doesn't work, then we should modify the formula or make a third approach.

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