Addition of Integers in Mixed Radix System

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ABSTRACT
In this paper, two integers with two radices and the sum of the integers in the mixed radix form is represented. In the second part of the paper, more than two radices are taken and obtained the sum of the integers. Also a MATLAB code is generated to obtain the mixed radix form of the number. The extension of the same procedure is done for *n*-integers and *n*-radices. The application of the mixed radix system is used in signal, image processing for data compression and many other computer applications.

Keywords
Mixed radix system, integers, radices.

1. INTRODUCTION
Let N be any integer consisting of radix r,

then $N = m_{n-1}r^{n-1} + ... + m_4r^4 + m_3r^3 + m_2r^2 + m_1r + m_0$.

In case of mixed radix form general representation is:

$N = m_{n-1}r_{n-1}...r_3r_2r_1 + ... + r_4r_3r_2r_1m_4 + r_3r_2r_1m_3 + r_2r_1m_2 + r_1m_1 + m_0,$

where $r_1, r_2, r_3, ..., r_{n-1}$ are different radices and when $r_1 = r_2 = r_3 = ... = r_{n-1} = r$, then mixed radix reduces to fixed radix system. Thus mixed radix is general and fixed radix is a special case of mixed radix system. N in case of a fixed radix can be decomposed by dividing N by r successively to get coefficients $m_0, m_1, m_2, ..., m_{n-1}$ as remainders. In case of mixed radix N can be decomposed by dividing N by r_1 to obtain m_0 as a remainder and quotient can then be divided by r_2 to obtain m_1 as remainder. The process can be continued till m_{n-1} is obtained. Thus n-tuple $(m_{n-1}, ..., m_2, m_1, m_0)$ is obtained representing number N.

From [1] results of mixed radix system are compared given by Kekre et al. In [2] work represented an algorithm which partitions a large mixed radix conversion problem into mixed radix problems of smaller size. The author explains the mixed radix representation of a number with respect to the radix vector in [3]. The theory presented by [4] was based on Reed-Muller expansions over Galois field arithmetic. The work explained real-life examples focusing on cryptographic circuits.

In [5], authors' comments on an arithmetic free parallel Mixed-Radix conversion algorithm. In [6], the work describes the magnitude comparison, sign detection and overflow detection for the residue number system was facilitated by converting the residue representations into the associated Mixed-Radix number system. The Chinese remainder theorem (CRT) and Mixed-Radix conversion (MRC) theorems were used to convert a residue number to its binary correspondence for a given moduli set. A new Mixed-Radix CRT possessed both the advantages of the CRT and the MRC, the efficiency of making modulo comparison in [7].

A new method was proposed for converting residue integers into a mixed radix notation. The method based upon a modified formulation of the Chinese Remainder Theorem and look-up table implementations was explained in [8]. In [9] applications have been shown for security using Mixed Radix design flow. In [10] the author explains modulo m_i addition time is independent of the word length of operands.

2. MIXED RADIX SYSTEM
Considering N_1 and N_2 as any integers consisting of radices r_1, r_2, then general representation of any integer is given below as:

$$N_1 = r_2r_1m_2 + r_1m_1 + m_0 \quad (1)$$

$$N_2 = r_2r_1n_2 + r_1n_1 + n_0 \quad (2)$$

$$N_1 + N_2 = r_2.r_1(m_2 + n_2) + r_1(m_1 + n_1) + (m_0 + n_0) \quad (3)$$

$$N_1 + N_2 - (m_0 + n_0) = r_2.r_1(m_2 + n_2) + r_1(m_1 + n_1)$$
$$(N_1 + N_2) - (m_0 + n_0) = r_1[r_2.(m_2 + n_2) + (m_1 + n_1)]$$
$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1} = r_2.(m_2 + n_2) + (m_1 + n_1)$$
$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1} - (m_1 + n_1) = r_2.(m_2 + n_2)$$
$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1r_2} - \frac{(m_1 + n_1)}{r_2} = (m_2 + n_2)$$
$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1r_2} - \frac{(m_1 + n_1)}{r_2} - (m_2 + n_2) = 0.$$

In Mixed Radix the combination can be

$r_1 = 2; r_2 = 3$ then $m_1 = 0,1;\ m_2 = 0,1,2$
$r_1 = 2; r_2 = 5$ then $m_1 = 0,1,2;\ m_2 = 0,1,2,3$
$r_1 = 2; r_2 = 7$ then $m_1 = 0,1,2,3;\ m_2 = 0,1,2,3,4$

and so on.

$r_1 = 2,3,5,7,11,13,...$

$r_2 = 3,5,7,11,13,...$

N_1 = even or odd.

N_2 = even or odd.

If N_1 = even; then value of $m_0 = 0$ and if N_1 = odd; then value of $m_0 = 1$.

If N_2 = even; then value of $n_0 = 0$ and if N_2 = odd; then value of $n_0 = 1$.

Thus $m_0 + n_0$ will take either 0, 1 or 2 depending on even or odd number.

3. TYPES OF MIXED RADIX FORM:

3.1 Case 1: If N_1 = even; N_2 = even.

If N_1 = even; then value of $m_0 = 0$, N_2 = even; then value of $n_0 = 0$.

(i) If $m_0 + n_0 = 0$. If $m_1 + n_1 = 0$. $m_2 + n_2$ will be equal to $\frac{(N_1 + N_2)}{r_1 r_2}$, which is quite obvious case.

(ii) If $m_0 + n_0 = 0; m_0 = 0, n_0 = 0$. $m_1 + n_1$ take values $1,2,3,...,\{(r_1 - 1) + (r_1 - 1) = 2(r_1 - 1)\}$;

$m_1 + n_1 = 1; m_1 = 1; n_1 = 0$ or $m_1 = 0; n_1 = 1$. $m_2 + n_2$ takes $\frac{(N_1 + N_2)}{r_1 r_2} - \frac{1}{r_2}$. $m_2 + n_2$ can take values $0,1,2,3,...,\{(r_1 r_2 - 1) + (r_1 r_2 - 1)\} = 2(r_1 r_2 - 1)$. For N_1 = even; N_2 = even, the output of results with all possible values of m_1, m_2, n_1, n_2 are considered under the criteria of Mixed Radix applicability with the help of a code generated in MATLAB and obtained the possible values of N_1 and N_2, along with $N_1 + N_2$.

```
% N1 is even and N2 is even
syms r1 r2 m1 m2 n1 n2 m0 n0 N1 N2;
 x=1;
  for  m1=0:1:(r1-1)
        for n1=0:1:(r1-1)
   for  m2=0:1:(r2-1)
        for n2=0:1:(r2-1)
            n0=0;
 m0=0;
  N1=r1.*r2.*m2+r1.*m1+m0;
 N2=r1.*r2.*n2+r1.*n1+n0;
 fprintf('\n    m2              n2            N1              N2
N1+N2\n')
fprintf('\n %3.4f    %3.4f  %3.4f     %3.4f      %3.4f\n',m2,n2,
N1, N2, N1+N2)
  x=x+1;
        end
    end
        end
end
```

3.2 Case 2: If N_1 = even; N_2 = odd.

If N_1 = even; then value of $m_0 = 0$, N_2 = odd; then value of $n_0 = 1$.

(i) If $m_0 + n_0 = 1$. Substituting in $\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1 r_2} - \frac{(m_1 + n_1)}{r_2} - (m_2 + n_2) = 0$,

with $m_1 + n_1 = 0$. $m_2 + n_2$ will be equal to $\frac{(N_1 + N_2) - 1}{r_1 r_2}$, which is quite obvious case.

(ii) If $m_0 + n_0 = 1; m_0 = 0$ and $n_0 = 1$.

$m_1 + n_1$ can take values $0,1,2,3,...,(r_1 - 1) + (r_1 - 1) = 2(r_1 - 1)$.

$m_2 + n_2$ can take values $0,1,2,3,...,\{(r_1 r_2 - 1) + (r_1 r_2 - 1)\} = 2(r_1 r_2 - 1)$. For N_1 = even; N_2 = odd, the output of results with all possible values of m_1, m_2, n_1, n_2 are considered under the criteria of Mixed Radix applicability with the help of a code generated in MATLAB and obtained the possible values of N_1 and N_2, along with $N_1 + N_2$.

```
% N1 is even and N2 is odd
syms r1 r2 m1 m2 n1 n2 m0 n0 N1 N2;
 x=1;
 for  m1=0:1:(r1-1)
        for n1=0:1:(r1-1)
            n0=1;
   for  m2=0:1:(r2-1)
        for n2=0:1:(r2-1)
            n0=1;
 m0=0;
  N1=r1.*r2.*m2+r1.*m1+m0;
 N2=r1.*r2.*n2+r1.*n1+n0;
 fprintf('\n    m2          m1          m0          n2
n1          n0          N1          N2      N1+N2\n')
fprintf('\n  %3.4f     %3.4f      %3.4f     %3.4f      %3.4f
%3.4f      %3.4f    %3.4f      %3.4f\n',m2,m1,m0,n2,n1, n0,
N1, N2, N1+N2)
  x=x+1;
        end
    end
        end
 end
```

3.3 Case 3: If N_1 = odd; N_2 = even.

If N_1 = odd; then value of $m_0 = 1$, N_2 = even; then value of $n_0 = 0$.

(i) If $m_0+n_0=1$. Substituting in

$$\frac{(N_1+N_2)-(m_0+n_0)}{r_1r_2}-\frac{(m_1+n_1)}{r_2}-(m_2+n_2)=0,$$

with $m_1+n_1=0$. m_2+n_2 will be equal to $\frac{(N_1+N_2)-1}{r_1r_2}$, which is quite obvious case.

(ii) If $m_0+n_0=1; m_0=1$ and $n_0=0$.

m_1+n_1 can take values $0,1,2,3,...,(r_1-1)+(r_1-1)=2(r_1-1)$.

m_2+n_2 can take values $0,1,2,3,...,\{(r_1r_2-1)+(r_1r_2-1)\}=2(r_1r_2-1)$.

For $N_1=\text{odd}; N_2=\text{even}$, the output of results with all possible values of m_1,m_2,n_1,n_2 are considered under the criteria of Mixed Radix applicability with the help of a code generated in MATLAB and obtained the possible values of N_1 and N_2, along with N_1+N_2.

```
% N1 is odd and N2 is even
syms r1 r2 m1 m2 n1 n2 m0 n0 N1 N2;
 x=1;
   for  m1=0:1:(r1-1)
        for n1=0:1:(r1-1)


  for m2=0:1:(r2-1)
        for n2=0:1:(r2-1)
            n0=0;
 m0=1;
  N1=r1.*r2.*m2+r1.*m1+m0;
 N2=r1.*r2.*n2+r1.*n1+n0;
 fprintf('\n  m2     m1     m0     n2     n1     n0     N1     N2     N1+N2\n')
fprintf('\n %3.4f  %3.4f  %3.4f  %3.4f  %3.4f  %3.4f  %3.4f  %3.4f  %3.4f\n',m2,m1,m0,n2,n1, n0, N1, N2, N1+N2)
  x=x+1;
        end
    end
        end
 end
```

3.4 Case 4: If $N_1=\text{odd}; N_2=\text{odd}$.

If $N_1=\text{odd}$; then value of $m_0=1, N_2=\text{odd}$; then value of $n_0=1$.

(i) If $m_0+n_0=2$. Substituting in

$$\frac{(N_1+N_2)-(m_0+n_0)}{r_1r_2}-\frac{(m_1+n_1)}{r_2}-(m_2+n_2)=0,$$

with $m_1+n_1=0$. m_2+n_2 will be equal to $\frac{(N_1+N_2)-2}{r_1r_2}$, which is quite obvious case.

(ii) If $m_0+n_0=2;\ m_0=1; n_0=1$.

m_1+n_1 can take values $0,1,2,3,...,(r_1-1)+(r_1-1)=2(r_1-1)$.

m_2+n_2 can take values $0,1,2,3,...,\{(r_1r_2-1)+(r_1r_2-1)\}=2(r_1r_2-1)$.

For $N_1=\text{odd}; N_2=\text{odd}$, the output of results with all possible values of m_1,m_2,n_1,n_2 are considered under the criteria of Mixed Radix applicability with the help of a code generated in MATLAB and obtained the possible values of N_1 and N_2, along with N_1+N_2.

```
% N1 is odd and N2 is odd
syms r1 r2 m1 m2 n1 n2 m0 n0 N1 N2;
 x=1;
  for  m1=0:1:(r1-1)
        for n1=0:1:(r1-1)
for  m2=0:1:(r2-1)
        for n2=0:1:(r2-1)
            n0=1;
 m0=1;
  N1=r1.*r2.*m2+r1.*m1+m0;
 N2=r1.*r2.*n2+r1.*n1+n0;
 fprintf('\n  m2     m1     m0     n2     n1     n0     N1     N2     N1+N2\n')
fprintf('\n %3.4f  %3.4f  %3.4f  %3.4f  %3.4f  %3.4f  %3.4f  %3.4f  %3.4f\n',m2,m1,m0,n2,n1, n0, N1, N2, N1+N2)
  x=x+1;
        end
    end
end
 end
```

3.5 Example 1:

Consider $r_1=2; r_2=3$

$$14=r_2r_1m_2+r_1m_1+m_0=3.2.m_2+2m_1+m_0 \quad (4)$$

$$9=r_2r_1n_2+r_1n_1+n_0=3.2.n_2+2.n_1+n_0 \quad (5)$$

$$23=3.2.(m_2+n_2)+2.(m_1+n_1)+(m_0+n_0) \quad (6)$$

$$23-(m_0+n_0)=3.2.(m_2+n_2)+2.(m_1+n_1)$$
$$23-(m_0+n_0)=2[3.(m_2+n_2)+(m_1+n_1)].$$
$$\frac{23-(m_0+n_0)}{2}=[3.(m_2+n_2)+(m_1+n_1)]$$

If $(m_0+n_0)=1$;

$(m_2+n_2)=3$;

$(m_1+n_1)=2$.

Let $m_0 = 0$ and $n_0 = 1$ in equation (4) and equation (5), an even number and odd number is obtained respectively.

Since $r_1 = 2$ so value of $m_1 = 1$ and $n_1 = 1$.

$14 = 3.2.m_2 + 2.1 + 0$.

$m_2 = 2$. Thus $n_2 = 1$.

Thus values of $m_0 = 0; m_1 = 1; m_2 = 2$.

Thus values of $n_0 = 1; n_1 = 1; n_2 = 1$.

4. ADDITION OF THREE NATURAL NUMBERS WITH MIXED RADIX:

$$N_1 = r_2 r_1 m_2 + r_1 m_1 + m_0 \quad (1)$$
$$N_2 = r_2 r_1 n_2 + r_1 n_1 + n_0 \quad (2)$$
$$N_3 = r_2 r_1 p_2 + r_1 p_1 + p_0 \quad (3)$$
$$N_1 + N_2 + N_3 = r_2.r_1(m_2 + n_2 + p_2) + r_1(m_1 + n_1 + p_1) + (m_0 + n_0 + p_0) \quad (4)$$
$$N_1 + N_2 + N_3 - (m_0 + n_0 + p_0) = r_2.r_1(m_2 + n_2 + p_2) + r_1(m_1 + n_1 + p_1)$$
$$(N_1 + N_2 + N_3) - (m_0 + n_0 + p_0) = r_1[r_2.(m_2 + n_2 + p_2) + (m_1 + n_1 + p_1)]$$
$$\frac{(N_1 + N_2 + N_3) - (m_0 + n_0 + p_0)}{r_1} = r_2.(m_2 + n_2 + p_2) + (m_1 + n_1 + p_1)$$
$$\frac{(N_1 + N_2 + N_3) - (m_0 + n_0 + p_0)}{r_1} - (m_1 + n_1 + p_1) = r_2.(m_2 + n_2 + p_2)$$
$$\frac{(N_1 + N_2 + N_3) - (m_0 + n_0 + p_0)}{r_1 r_2} - \frac{(m_1 + n_1 + p_1)}{r_2} = (m_2 + n_2 + p_2)$$
$$\frac{(N_1 + N_2 + N_3) - (m_0 + n_0 + p_0)}{r_1 r_2} - \frac{(m_1 + n_1 + p_1)}{r_2} - (m_2 + n_2 + p_2) = 0$$

In the similar manner, if $N_1 = \text{even}; N_2 = \text{even}; N_3 = \text{even}$.
If $N_1 = \text{even}$; then value of $m_0 = 0, N_2 = \text{even}$; then value of $n_0 = 0$; $N_3 = \text{even}$, then value of $p_0 = 0$.

If $m_0 + n_0 + p_0 = 0$. If $(m_1 + n_1 + p_1) = 0$. $(m_2 + n_2 + p_2)$ will be equal to $\frac{(N_1 + N_2 + N_3)}{r_1 r_2}$, which is quite obvious case.

If $m_0 + n_0 + p_0 = 0; m_0 = 0, n_0 = 0; p_0 = 0$.

$m_1 + n_1 + p_1$ take values $1,2,3,...,\{(r_1 - 1) + (r_1 - 1) = 2(r_1 - 1)\}$;

$m_1 + n_1 + p_1 = 1$;

$m_1 = 1; n_1 = 0; p_1 = 0$

or $m_1 = 0; n_1 = 1, p_1 = 0$

or $m_1 = 0; n_1 = 0, p_1 = 1$

$(m_2 + n_2 + p_2)$ takes $\frac{(N_1 + N_2)}{r_1 r_2} - \frac{1}{r_2}$.

$m_2 + n_2$ can take values $0,1,2,3,...,\{(r_1 r_2 - 1) + (r_1 r_2 - 1)\} = 2(r_1 r_2 - 1)$.

For $N_1 = \text{even}; N_2 = \text{even}, N_3 = \text{even}$; the output of results with all possible values of $m_1, m_2, n_1, n_2, p_1, p_2$ are considered under the criteria of Mixed Radix applicability with the help of a code generated in MATLAB and obtained the possible values of N_1, N_2 and N_3, along with $N_1 + N_2 + N_3$.

```
% N1 is even , N2 is even and N3 is even
syms r1 r2 m1 m2 n1 n2 m0 n0 p1 p2 p0 N1 N2 N3;
 x=1;
 for  m1=0:1:(r1-1)
        for n1=0:1:(r1-1)
            for p1=0:1:(r1-1)
  for  m2=0:1:(r2-1)
        for n2=0:1:(r2-1)
            for p2=0:1:(r2-1)
            n0=0;
m0=0;
p0=0;
 N1=r1.*r2.*m2+r1.*m1+m0;
N2=r1.*r2.*n2+r1.*n1+n0;
N3=r1.*r2.*p2+r1.*p1+p0;
fprintf('\n  m2            m1          m0          n2
n1          n0             p0        p1          p2
N1            N2            N3         N1+N2+N3\n')
fprintf('\n %3.4f    %3.4f     %3.4f    %3.4f     %3.4f
%3.4f     %3.4f     %3.4f     %3.4f           %3.4f       %3.4f
%3.4f     %3.4f\n',m2,m1,m0,n2,n1, n0, p0,p1,p2,N1, N2,
N3,N1+N2+N3)
 x=x+1;
            end
        end
  end
     end
        end
end
```

All other possible ways in which the mixed radix addition can be in the following manners:

$N_1 = \text{even}; N_2 = \text{even}, N_3 = \text{odd}$
$N_1 = \text{even}; N_2 = \text{odd}, N_3 = \text{odd}$
$N_1 = \text{odd}; N_2 = \text{even}, N_3 = \text{odd}$
$N_1 = \text{odd}; N_2 = \text{even}, N_3 = \text{even}$
$N_1 = \text{odd}; N_2 = \text{odd}, N_3 = \text{odd}$
$N_1 = \text{even}; N_2 = \text{odd}, N_3 = \text{even}$
$N_1 = \text{odd}; N_2 = \text{odd}, N_3 = \text{even}$

A code is generated in the similar manner and obtained all values for the initial radices and values of the sum of the possible integers in the similar manner.
These representations can be extended to *n*-numbers and find the possible sum of these numbers by considering the possible values of $a_2, a_1, a_0, b_2, b_1, b_0, ...$ in the same way.

$$N_1 = r_2 r_1 a_2 + r_1 a_1 + a_0$$
$$N_2 = r_2 r_1 b_2 + r_1 b_1 + b_0$$
$$N_3 = r_2 r_1 c_2 + r_1 c_1 + c_0$$
$$N_4 = r_2 r_1 d_2 + r_1 d_1 + d_0$$
.
.
.
$$N_n = r_2 r_1 n_2 + r_1 n_1 + n_0$$
.
.
.

Considering the numbers in more than three radices:

$$N_1 = r_4 r_3 r_2 r_1 m_4 + r_3 r_2 r_1 m_3 + r_2 r_1 m_2 + r_1 m_1 + m_0$$
$$N_2 = r_4 r_3 r_2 r_1 n_4 + r_3 r_2 r_1 n_3 + r_2 r_1 n_2 + r_1 n_1 + n_0$$

$$N_1 + N_2 = r_4 r_3 r_2 r_1 (m_4 + n_4) + r_3 r_2 r_1 (m_3 + n_3) + r_2 . r_1 (m_2 + n_2) + r_1 (m_1 + n_1) + (m_0 + n_0)$$

$$N_1 + N_2 - (m_0 + n_0) = r_4 r_3 r_2 r_1 (m_4 + n_4) + r_3 r_2 r_1 (m_3 + n_3) + r_2 . r_1 (m_2 + n_2) + r_1 (m_1 + n_1)$$

$$(N_1 + N_2) - (m_0 + n_0) = r_1 [r_4 r_3 r_2 (m_4 + n_4) + r_3 r_2 (m_3 + n_3) + r_2 (m_2 + n_2) + (m_1 + n_1)]$$

$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1} = r_4 r_3 r_2 (m_4 + n_4) + r_3 r_2 (m_3 + n_3) + r_2 (m_2 + n_2) + (m_1 + n_1)$$

$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1} - (m_1 + n_1) = r_4 r_3 r_2 (m_4 + n_4) + r_3 r_2 (m_3 + n_3) + r_2 (m_2 + n_2)$$

$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1 r_2} - \frac{(m_1 + n_1)}{r_2} = r_4 r_3 (m_4 + n_4) + r_3 (m_3 + n_3) + (m_2 + n_2)$$

$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1 r_2} - \frac{(m_1 + n_1)}{r_2} - (m_2 + n_2) = r_4 r_3 (m_4 + n_4) + r_3 (m_3 + n_3)$$

$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1 r_2 r_3 r_4} - \frac{(m_1 + n_1)}{r_4 r_3 r_2} - \frac{(m_2 + n_2)}{r_4 r_3} - \frac{(m_3 + n_3)}{r_4} = (m_4 + n_4)$$

$$\frac{(N_1 + N_2) - (m_0 + n_0)}{r_1 r_2 r_3 r_4} - \frac{(m_1 + n_1)}{r_4 r_3 r_2} - \frac{(m_2 + n_2)}{r_4 r_3} - \frac{(m_3 + n_3)}{r_4} - (m_4 + n_4) = 0$$

All other possible ways in which the mixed radix addition can be in the following manners:

```
% N1 is even , N2 is even;
syms r1 r2 m1 m2 n1 n2 m0 n0 N1 N2;
 x=1;
for   m1=0:1:(r1-1)
        for n1=0:1:(r1-1)
  for  m2=0:1:(r2-1)
        for n2=0:1:(r2-1)
  for  m3=0:1:(r3-1)
        for n3=0:1:(r3-1)
  for  m4=0:1:(r4-1)
        for n4=0:1:(r4-1)
           n0=0;
           m0=0;

N1=r1.*r2.*r3.*r4.*m4+r1.*r2.*r3.*m3+r1.*r2.*m2+r1.*m1+
m0;

N2=r1.*r2.*r3.*r4.*m4+r1.*r2.*r3.*m3+r1.*r2.*m2+r1.*m1+
m0;
 fprintf('\n   m4         m3          m2              m1           m0
n4             n3          n2             n1                 n0
N1             N2                 N1+N2\n')
fprintf('\n %3.4f     %3.4f      %3.4f     %3.4f      %3.4f
%3.4f     %3.4f     %3.4f      %3.4f             %3.4f         %3.4f
%3.4f      %3.4f\n',m4,m3,m2,m1,m0,n4,n3,n2,n1, n0, N1,
N2, N1+N2)
  x=x+1;
  end
        end
  end
           end
 end
           end
end
           end
```

Thus in general the numbers can be calculated by mixed radix method for a given set of radices.

General representation is:

$$N = m_{n-1} r_{n-1} ... r_3 r_2 r_1 + ... + r_4 r_3 r_2 r_1 m_4 + r_3 r_2 r_1 m_3 + r_2 r_1 m_2 + r_1 m_1 + m_0,$$

where $r_1, r_2, r_3, ..., r_{n-1}$ are different radices.

5. APPLICATION

This method is very much useful in computer applications, in reading or sorting a particular number N from the multidimensional array or sequence of numbers from its specified location. And if the distance is specified from an existing number, then by adding N to the distance the next number can be obtained.

6. CONCLUSION

In this paper, a simple to understand and easily applied mixed radix system for addition of integers with known radices is developed. Initially a code is developed for two numbers and later developed not only for more than two numbers but also more than two radices. Here any number of integers with more than two radices can be added and obtained all the possible results of the addition of integers represented as a result of mixed radix system. Due to developed MATLAB code also the process becomes simpler and readily available to use.

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