

Math

function

$$f(n) =$$

factorial of n

$$\text{Let } y = \text{fact}(n)$$

$n=5$

$5 \times 4 \times 3 \times 2 \times 1$

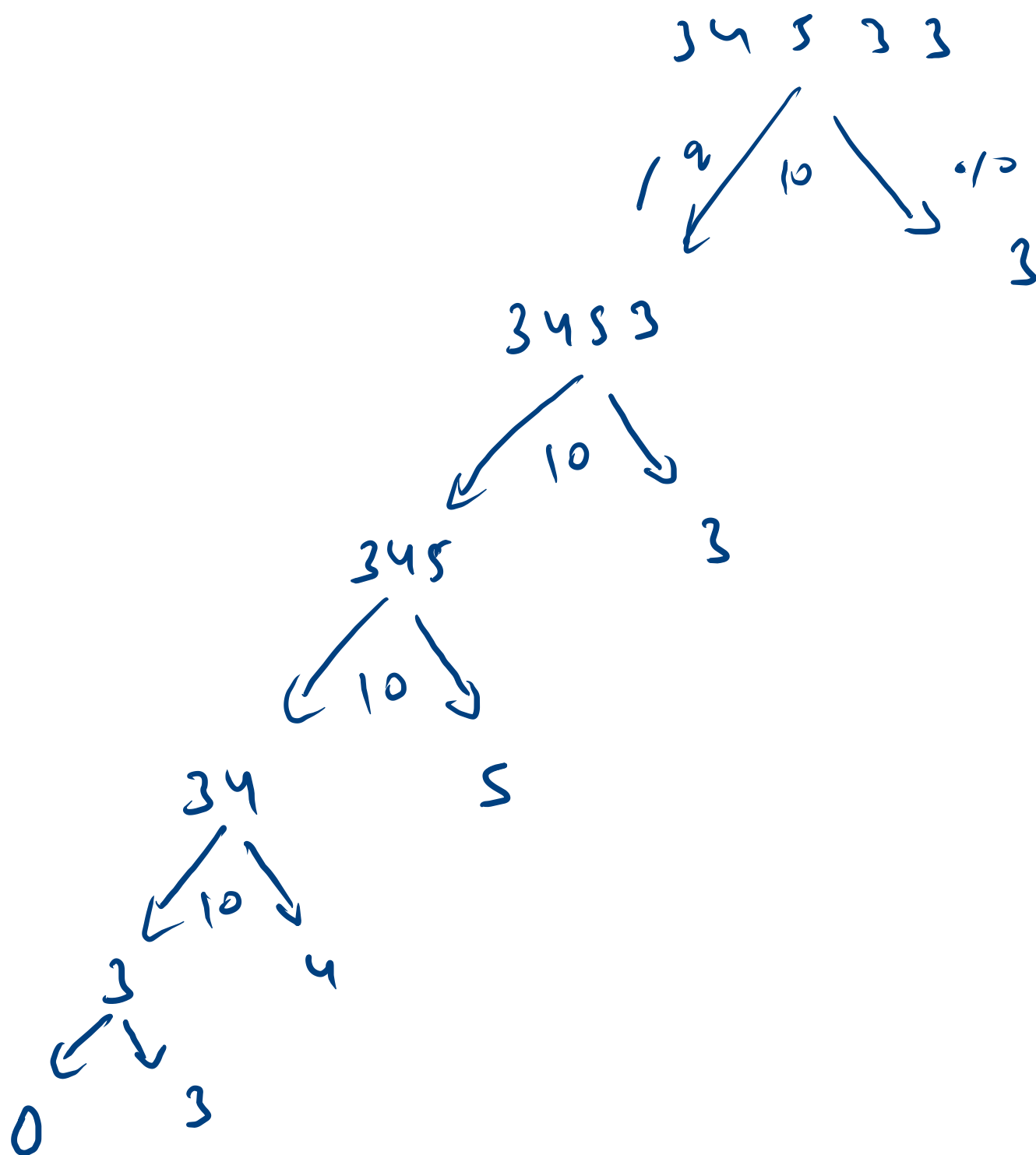
Java

```
int fact(int n) {  
    int f = 1;  
    for (int i = 1; i <= n; i++)  
        f = f * i;  
    return f;  
}
```

$h = \underline{3} \ 4 \ 2 \ \underline{3} \ 2 \ \underline{3} \ 4 \ 5 \ \underline{3}$

$d = 3$

0
4



count 20

1

2

2

2

3

0...9 Decimal

00	10	20	30	90	100
01	11				
02	12				
3	13				
4	14				
5	15				
6					
7	17				
8	18	28		98	
9	19	29		99	

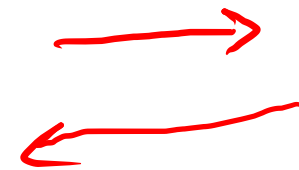
decimal → binary

0	→	0
1	→	01
2	→	10
3	→	11
4	→	100
5	→	101

0,1 ← Binary

0	10	100	1000
01	011	101	
		110	
		0111	

conversion
 decimal → binary
 decimal → octal



octal

0...7

0	10	20
1	11	
2	12	
3		
4		
5		
6	16	
07	17	

decimal

octal

0	→	0
1	→	1
2	→	2
	⋮	
7	→	7
8	→	10
9	→	11
10	→	12

hexadecimal

0...9 A B C D E F

16

decimal 82

$$(5)_{10} \rightarrow (?)_2$$

2	13		
2	6	1	✓
2	3	0	✓
2	1	1	✓
	0	1	✓

1101

A	B
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101

2	82	
2	41	0
2	20	1
2	10	0
2	5	0
2	2	1
2	1	0
	0	1

$$(82)_{10} \rightarrow (1010010)_2$$

$\textcircled{01}$ ←
 ✓

$$(82)_{10} \rightarrow (777)_{122}$$

$\textcircled{8}$ ← 01...2

8	82	
8	10	2
8	1	2
	0	1

invert

$$(n)_{10} \longrightarrow (??)_{(b)} \quad 2, 8, 3, 5, 7$$

$$(57)_{10} \longrightarrow (??)_{(b)} \quad \downarrow \quad 3$$

b = 3	n = 57	
b = 3	q = 19 n	r = 0 $\times 10^0$
b = 3	q = 6 n	r = 1 $\times 10^1$
b = 3	q = 2 n	r = 0 $\times 10^2$
	q = 0 n	r = 2 $\times 10^3$

$$\begin{array}{r} 2010 \\ \hline + \quad 00 \\ + \quad 000 \\ + \quad 2000 \\ \hline \end{array}$$

$! \times (int) \text{math.pow}(10, \text{pow})$

int ans = 0 n, b
pow = 0

while (n != 0)

q = n / b

r = n % b

fact = r $\times 10^{\text{pow}}$
ans = ans + fact
pow = pow + 1

n = q

}

```

public static void main(String[] args) {
    Scanner scn = new Scanner(System.in);
    • int n = scn.nextInt();
    • int b = scn.nextInt();
    • int dn = getValueInBase(n, b);
    System.out.println(dn);
}

```

```

public static int getValueInBase(int n, int b){
    • int ans=0;
    • int pow=0;

    • while( n != 0 ){
        • int q = n/b;
        • int r = n%b;

        • int fac = r*(int)Math.pow(10, pow);
        • ans = ans+fac;

        pow++;
        n=q;
    }

    return ans;
}

```

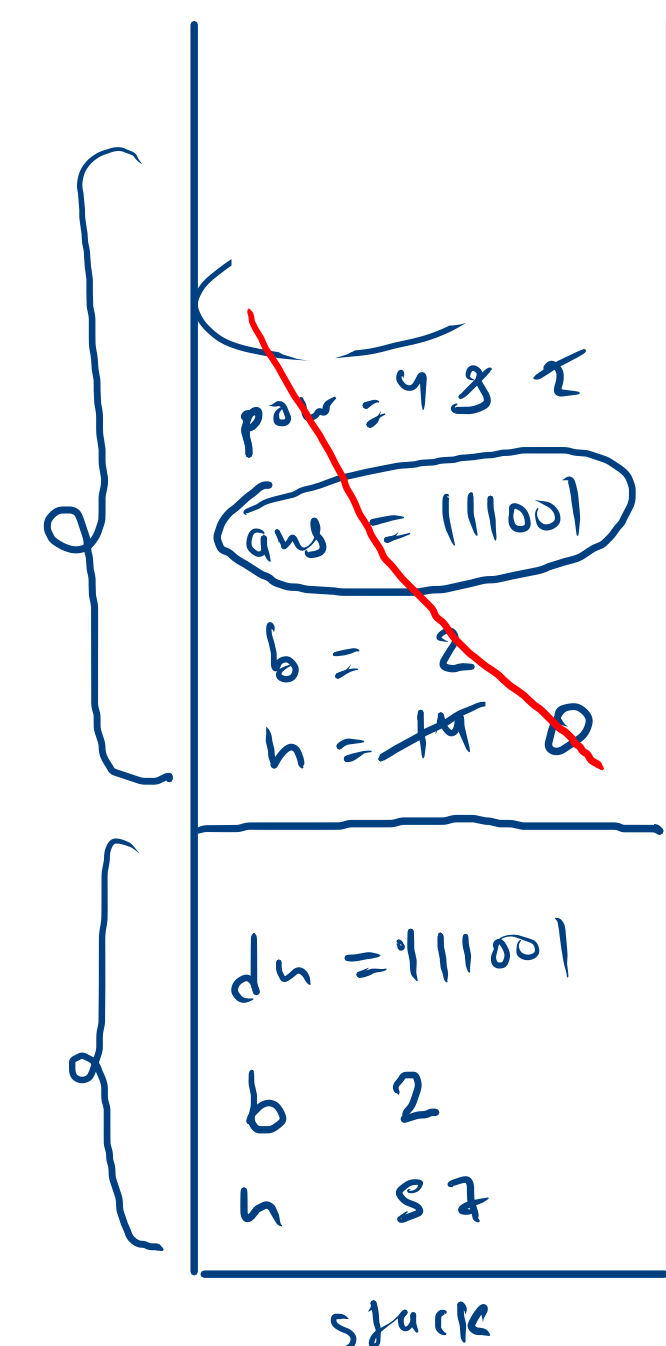
111001

Saru

8×10^3
 1×1000
 ≈ 1000

gvlbun

main



heap

$$(111001)_2 \rightarrow \begin{matrix} 52 \\ (\quad ?) \end{matrix}_{10}$$

$$(111001)_2 \rightarrow (52)_{10}$$

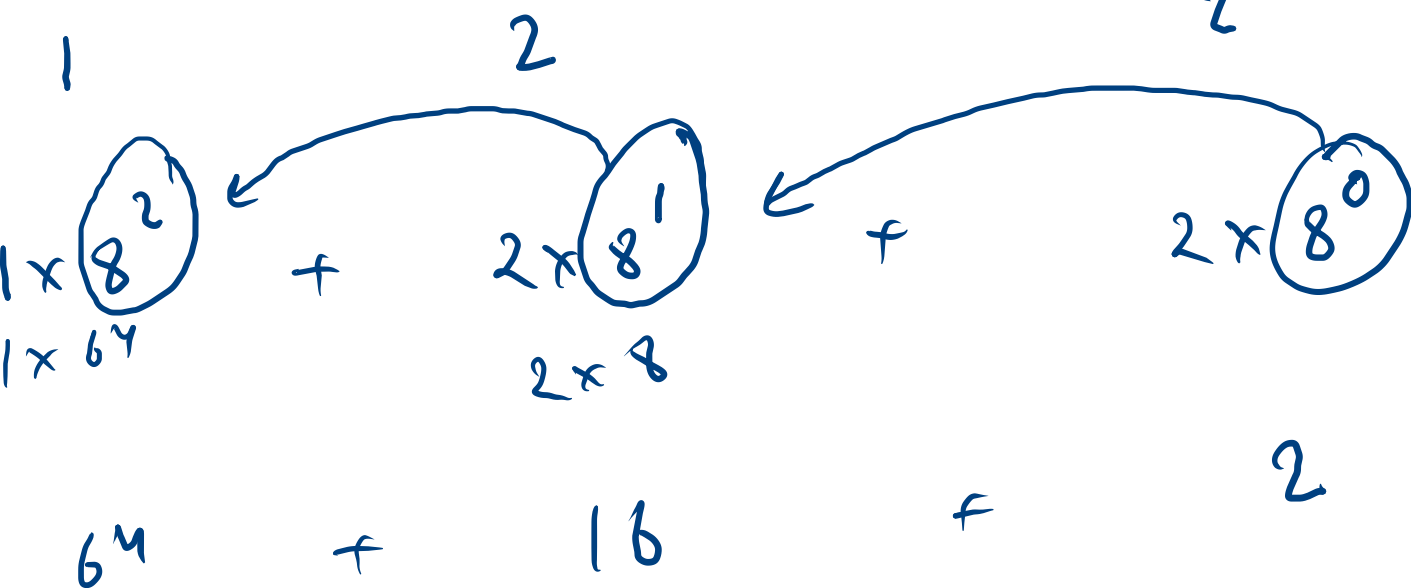
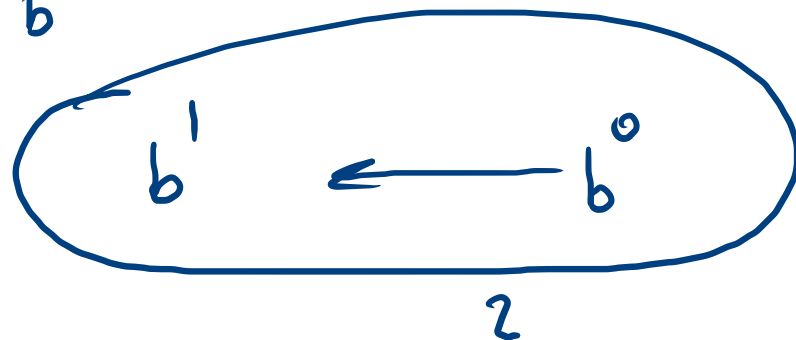
1 1 1 0 0 1

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

$$32 + 16 + 8 + 0 + 0 + 1$$

$$\begin{array}{r} 1 \\ 32 \\ + 16 \\ + 8 \\ + 1 \\ \hline 57 \end{array}$$

$$\begin{matrix} & 2 & 1 & 0 \\ 8 & 8 & 8 \\ \left(\begin{matrix} 1 & 2 & 2 \end{matrix} \right) & & \\ n & & b \end{matrix} \rightarrow (82)_{10}$$



```
int ans = 0
int multi = 1; b^0
```

```
while (n != 0) {
```

```
    int q = n / 10
```

```
    r = n % 10
```

```
    fac = r * multi
```

```
    ans = ans + fac
```

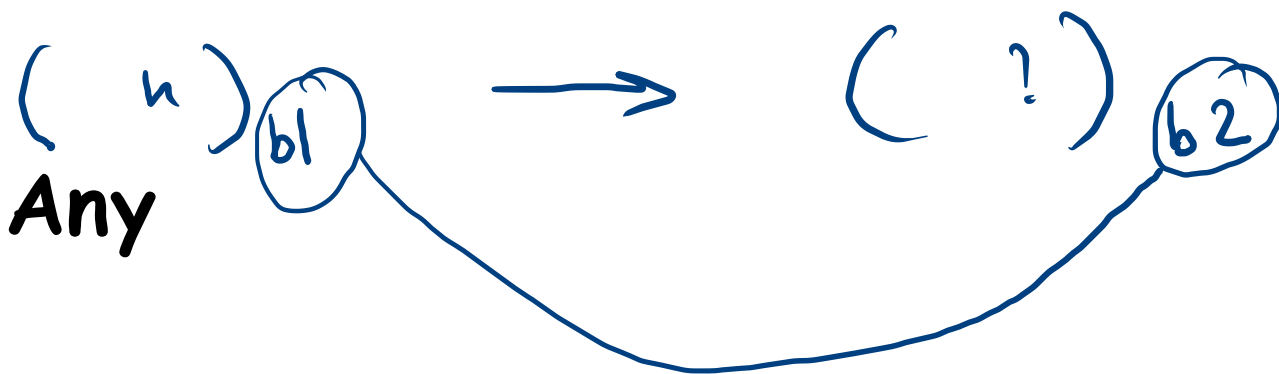
```
    multi = multi * b;
```

```
    n = q
```

```
}
```

H.W.

Any Base To Any
Base



ans b_1 to decimal

decimal to ans base

$$b = 10 \quad \boxed{0 \dots 9}$$

$$h_1 = 233$$

$$h_2 = 38$$

$$\begin{array}{r} 221 \end{array}$$

$$\begin{array}{r} 1 \\ 233 \\ 038 \\ \hline 271 \end{array}$$

$$b = 8$$

$$\boxed{0 \dots 7}$$

$$h_1 = 567$$

$$h_2 = 111$$

$$\begin{array}{r} 700 \end{array}$$

$$\begin{array}{r} 11 \\ 567 \\ + 111 \\ \hline 700 \end{array}$$

$$\begin{array}{r} 010 \\ 12 \\ \vdots \\ 2 \end{array}$$

$$b = 10$$

$[0 \dots 9]$

$$h1 = 793$$

$$h2 = 248$$

$$\begin{array}{r} 1 \quad 1 \quad 1 \\ 0 \quad 7 \quad 9 \quad 3 \\ 0 \quad 2 \quad 4 \quad 8 \\ \hline 1 \quad 0 \quad 4 \quad 1 \end{array}$$

$$\begin{array}{c} 14 \\ \downarrow \\ (10) + 4 \end{array}$$

$$\begin{array}{c} 10 \\ \downarrow \\ 10 + 0 \end{array}$$

$$b = 8$$

$[0 \dots 7]$

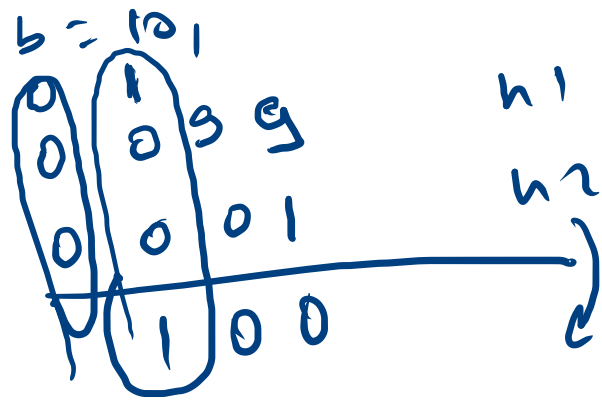
$$h1 = 567$$

$$h2 = 111$$

$$\begin{array}{r} 1 \quad 1 \\ 5 \quad 6 \quad 7 \\ 1 \quad 2 \quad 3 \\ \hline 7 \quad 1 \quad 2 \end{array}$$

$$\begin{array}{c} 9 \\ \downarrow \\ (8) + 1 \end{array}$$

$b = 8$
 $n1 = 567$
 $n2 = 123$



$\Rightarrow 7$

$int\ carry = 0;$
 $int\ multi = 1; 10^0$
 $int\ ans = 0$

```

while ( ) {
    q1 = n1 / 10
    r1 = n1 % 10

    q2 = n2 / 10
    r2 = n2 % 10
    sum = r1 + r2 + carry

    carry = sum / b
    digit = sum % b
    ans = ans + digit * multi
    multi = multi * 10
    n1 = q1; n2 = q2
}

```

011
 567
 123
 $n1$
 $n2$

712

2×10^0
 10×10^1
 700×10^2

```

int ans=0;
int multi = 1; // 10 ^ 0
int carry=0;
while( n1>0 || n2 >0 || carry > 0 ){
    int q1 = n1/10;
    int r1 = n1%10;
    int q2 = n2/10;
    int r2 = n2%10;

    int sum = r1+r2+carry;

    carry = sum/b;
    int digit = sum%b;
    // ans

    ans += digit*multi;

    multi *= 10;
    n1 = q1;
    n2 = q2;
}
return ans;

```

$$b = 8$$

$$n1 = 241$$

$$n2 = 2$$

$$\begin{array}{r} \cancel{241} \\ 71 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 1 \\ 74 \\ 07 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 1 \\ 7 \\ 0 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 1 \\ 0 \\ 0 \\ \hline 1 \end{array} \rightarrow \begin{array}{r} 0 \\ 0 \\ 0 \\ \hline 0 \end{array}$$

$$q1 = 24$$

$$r1 = 1$$

$$q2 = 2$$

$$r2 = 1$$

$$q1 = 2$$

$$r1 = 4$$

$$q2 = 0$$

$$r2 = 2$$

$$\begin{array}{r} 11 \\ 097 \\ 6+01 \\ \hline 100 \end{array}$$

H.W.

Any Base Subtraction

$$b = 8$$

$$n_1 = 34$$

$$n_2 = 721$$

$$n_2 > n_1$$

$$\begin{array}{r} \overset{8}{-1} \overset{\curvearrowright}{(-1)} + 8 \\ 7 2 1 \\ - 0 3 4 \\ \hline 6 6 5 \end{array}$$

$$\begin{array}{r} 2 \\ - 3 \\ \hline -1 \\ -1 \\ \hline -2 \\ + 8 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 7 \\ - 0 \\ \hline 7 \\ - 1 \\ \hline 6 \end{array}$$

$b = 5$
 $n = 1220$

$$w_2 = 31$$

$n_2 \times n_1$ ← multiply with scalar (b, n_2, d_1)
 and then addition (b, n_1, n_2)
 $n_1 + n_2$

$$\begin{array}{r} w_2 \rightarrow 31 \\ w_1 \rightarrow 1220 \\ \hline 00 \quad \times 10^0 \\ + 1120 \quad \times 10^1 \\ + 11200 \quad \times 10^2 \\ + 31000 \quad \times 10^3 \\ \hline \Rightarrow 43320 \end{array}$$

$$\begin{array}{r} 1220 \\ 3 \\ \hline 4210 \end{array}$$

$$\text{mult} = 1 \times 10^9$$

$$\text{ans} = 0$$

$$LW^2(4150) \text{ L}$$

$$q = 41/10$$

$$\gamma \in \mathbb{N}^{1 \times p/q}$$

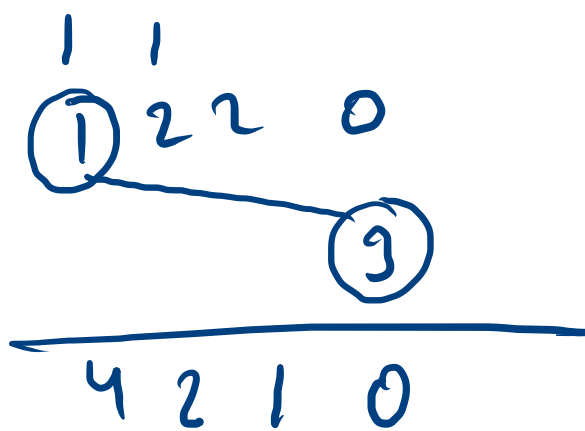
$$p_{\gamma} = \text{MLSD}(b, u_2, \gamma)$$

aniz abg (b, an,
pro multi)

$$w_1 = q$$



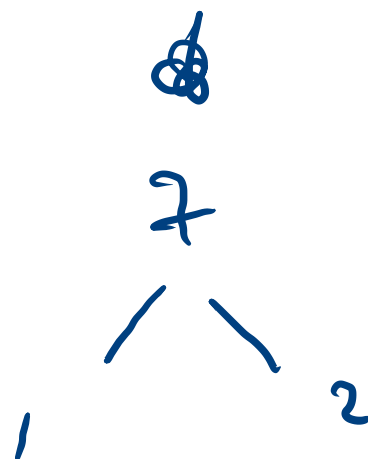
0



h1

d

$b=5$



$$3 + 1 = \textcircled{4}$$

$$\text{sum} = r1 + r2 + \text{carry}$$
$$\text{pro} = \textcircled{r1} \times \textcircled{r2} + \text{carry}$$