

CROSS + ROAD = DANGER.

$$\begin{array}{r}
 C R O S S \\
 R O A D S \\
 \hline
 D A N G E R
 \end{array}$$

[assign value from 0 to 9
No two letters have same number]

1) $D=1$, since it is carry-over possible from the sum of numbers in column 4

$$D=1.$$

$$2) S + S = R$$

if S is odd, then R is even.

if S is even, then R is even.

\therefore The possible values of R is $(0, 2, 4, 6, 8)$

Consider $S=2$

Then the value of R is

Rule: No two letters have same number
we already the value 1 to D

$$\therefore S \neq 1.$$

Consider $S=2$

Then the value of R is 4

$$\begin{array}{r}
 C \quad R^{(4)} \quad O \quad S^{(2)} \quad S^{(2)} \\
 R^{(4)} \quad O \quad A \quad D^{(1)} \quad S^{(2)} \\
 \hline
 \textcircled{1} D \quad A \quad N \quad G \quad E^{(3)} \quad R^{(4)}
 \end{array}$$

Consider column 5

Case ① $C + R \geq 10$ (without carry)

Case ② $1 + C + R \geq 10$ (with carry)

Sub $R = 4$ in both cases.

① $C + 4 \geq 10$

$$C \geq 10 - 4$$

$$C \geq 6$$

$$C = \{6, 7, 8, 9\}$$

② $1 + C + R \geq 10$

$$1 + C + 4 \geq 10$$

$$C + 5 \geq 10$$

$$C \geq 5$$

$$C = \{5, 6, 7, 8, 9\}$$

If we sub $C = 5$

$$\begin{array}{r} C5R \quad 0 \quad S \quad S \\ R40 \quad A \quad D \quad S \\ \hline D \quad A^{(9)} \quad N \quad G \quad E \quad R \end{array}$$

$$C + R =$$

$S + 4 = 9 \rightarrow$ it does not carry number

\therefore Base 2 is not applicable.

Consider $C = 6$

$$C(6) \quad R(4) \quad 0 \quad S(2) \quad S(2)$$

$$R(4) \quad 0 \quad A(0) \quad D(1) \quad S(2)$$

$$\begin{array}{r} 1) \\ D \quad A(0) \quad N \quad G \quad E(3) \quad R(4) \end{array}$$

Consider column 2,

$$0 + 0 = G.$$

if we put any value in 0,
then the G is also get the same
value.

$$\therefore C \neq 6.$$

Consider $C = 7$

$C(7)$	$R(4)$	0	$S(2) S(2)$
$R(4)$	0	A	$D(1) S(2)$
<hr/>			
$D(1)$ A	N	G	$E(3) R(4)$

$$\begin{aligned} \text{if } C = 7 \text{ then } C + R \\ \Rightarrow 7 + 4 = 11 \\ \text{then } A = 1 \end{aligned}$$

But we already assign the value 1
in D.

$$\therefore C \neq 7$$

Consider:

$$C = 8.$$

$$\begin{array}{rcccl} C(8) & R(4) & 0 & S(2) & S(2) \\ R(A) & 0 & A & D(1) & S(2) \\ \hline D(1) & A & N & G & E(3) & R(4) \end{array}$$

$$\text{if } C = 8, \quad C + R \Rightarrow 8 + 4 = 12.$$

$$\text{then } A = 2.$$

But we assign the value 2 to q .

$$\therefore C \neq 8.$$

Consider $C = 9$.

$$\begin{array}{rcccl} C(9) & R(4) & 0 & S(2) & S(2) \\ R(4) & 0 & A & D(1) & S(2) \\ \hline D(1) & A & N & G & E(3) & R(4) \end{array}$$

$$\text{if } C = 9, \quad C + R \Rightarrow 9 + 4 = 13$$

$$A = 3.$$

But we already assign the value 3 to E

$$\therefore C \neq 9$$

\therefore Our step (2) $S = 2$ is not correct.
So consider $S = 3$,

$$\begin{array}{ccccccc}
 C & R(6) & 0 & S(9) & S(3) & & \\
 (6)R & 0 & A & D(1) & S(3) & & \\
 \hline
 D(1) & A & N & G & E(4) & R(6) &
 \end{array}$$

Consider column 5,

case ① :- $C + R \geq 10$ (without carry)

case ② :- $1 + C + R \geq 10$ (with carry)

Sub $R = 6$ in both cases.

$$C + 6 \geq 10$$

$$1 + C + 6 \geq 10$$

$$C \geq 10 - 6$$

$$C \geq 10 - 7$$

$$C \geq 4$$

$$C \geq 3.$$

$$C = \{3, 4, 5, 6, 7, 8, 9\}$$

if $C \neq 3$ because $S = 3$

$C \neq 4$ because $E = 4$

if $C = 5$,

see the column 5,

$$C + R \Rightarrow 5 + 6 = 11$$

then $A = 1$.

But $D = 1$

$$\therefore C \neq 5$$

$C \neq 6$, because $R = 6$.

if $C = 7$

$$C + R \Rightarrow 7 + 6 = 13$$

$$\text{then } A = 3$$

$$\text{But } S = 3$$

$$\therefore C \neq 7$$

if $C = 8$

$$C + R \Rightarrow 8 + 6 = 14$$

$$\text{then } A = 4$$

$$\text{But } R = 4$$

$$\therefore C \neq 8$$

Then consider $C = 9, A = 5$

$$C(9) \quad R(6) \quad O \quad S(3) \quad S(3)$$

$$R(6) \quad D \quad A(5) \quad D(1) \quad S(3)$$

$$D(1) \quad A(5) \quad N \quad G \quad E(4) \quad R(6)$$

Now there is 2 equations,

$$6 + O = N$$

$$O + 5 = G$$

$$6 + O < 10$$

$$O < 4$$

$$O = \{4, 3, 2, 1\}$$

$$O \neq 4, \text{ becoz } R = 4$$

$$O \neq 3, \text{ becoz } S = 3$$

$$O \neq 1, \text{ becoz } D = 1$$

then sub $O = 2$

C(9) R(6) O(2) S(3) S(3)

R(6) O(2) A(5) D(1) S(3)

D(1) A(5) N(8) G(7) E(4) R(6)

9 6 2 3 3

6 2 5 1 3

1 5 8 7 4 6
