CROSS + ROADS = DANGER

C R O S S

R O A D S

D A N G E R.

[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 5

D = 1.

2) S + S = R

if S is odd, then R is even.

if S is even, then R is even.

∴ The possible values of R is (0, 2, 4, 6, 8)

Consider S = 1

~~Then the value of R is~~

Rule: No two letters have same number

we already the value 1 to D

∴ S ≠ 1.

Consider S = 2

Then the value of R is 4

C R④ O S② S②

R④ O A D① S②

① D A N G E③ R④

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 $C = 5$

$$\begin{array}{cccccc} C & 5 & R & O & S & S \\ R & 4 & O & A & D & S \\ \hline D & A^{(9)} & N & G & E & R \end{array}$$

$C + R =$

$5 + 4 = 9 \rightarrow$ it do. not carry number

∴ Case 2 is not applicable

Consider $C = 6$

$$\begin{array}{cccccc} C(6) & R(4) & O & S(2) & S(2) \\ R(4) & O & A(0) & D(1) & S(2) \\ \hline D^{(1)} & A(0) & N & G & E(3) & R(4) \end{array}$$

Consider column 3,

$O + O = G_7$.

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

$\therefore c \neq 6$.

Consider $c = 7$

$$\begin{array}{cccc} C(7) & R(4) & O & S(2)\ S(2) \\ R(4) & O & A & D(1)\ S(2) \\ \hline D^{(1)} & A & N & G \quad E(3)\ R(4) \end{array}$$

if $c = 7$ then $c + R$

$\Rightarrow 7 + 4 = 11$

then $A = 1$

But we already assign the value 1 in D.

$\therefore c \neq 7$

Consider:

$C = 8$.

C(8)	R(4)	O	S(2) S(2)
R(4)	O	A	D(1) S(2)
D(1)	A	N	E(3) R(4)

if $C = 8$, $C + R \Rightarrow 8 + 4 = 12$.

Then $A = 2$.

But we assign the value 2 to 8.

$\therefore C \neq 8$.

Consider $C = 9$.

C(9)	R(4)	O	S(2) S(2)
R(4)	O	A	D(1) S(2)
D(1)	A	N	G E(3) R(4)

if $C = 9$, $C + R \Rightarrow 9 + 4 = 13$

$A = 3$.

But we already assign the value 3 to E

$\therefore C \neq 9$

Our step (2) $S = 8$ is not correct.

So consider $S = 3$,

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

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

D(1) A N G E(4) R(6)

Consider column 5,

case ① :- C + R ≥ 10 (without carry)

case ② :- 1 + C + R ≥ 10 (with carry)

Sub R = 6 in both cases.

$C + 6 \geq 10$

$C \geq 10 - 6$

$C \geq 4$

$1 + C + 6 \geq 10$

$C \geq 10 - 7$

$C \geq 3.$

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

$C \neq 3$ because S = 3

$C \neq 4$ because E = 4

if C = 5,

see the column 5,

C + R ⇒ 5 + 6 = 11

then A = 1.

But D = 1

$\therefore C \neq 5$

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

if $C = 7$

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

then $A = 3$

But $S = 3$

$\therefore C \neq 7$

if $C = 8$

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

then $A = 4$

But $R = 4$

$\therefore C \neq 8.$

Then consider $C = 9$, $A = 5$

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

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

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

Now there is 2 equations,

$6 + O = N$ | $O + 5 = G$.

$6 + O < 10$

$O < 4$

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

$O \neq 4$, becoz $R = 4$

$O \neq 3$, becoz $S = 3$

$O \neq 1$, beacoz $D = 1$

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)

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9 6 2 3 3

6 2 5 1 3

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1 5 8 7 4 6