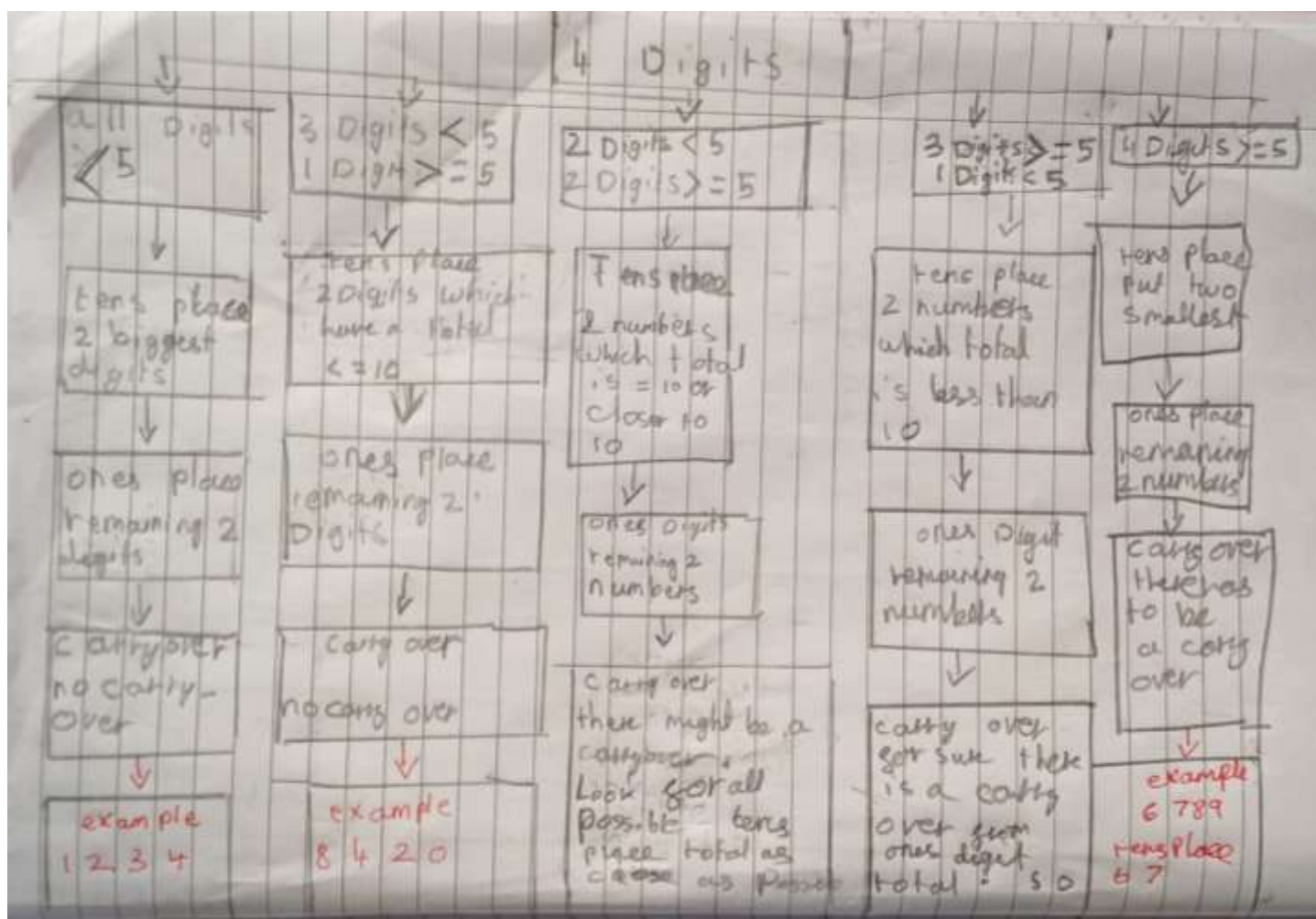


Solution for "Dicey Operations" NRICH primary live problem

Hello NRICH team,

I am Valan Sadanandam from Sutton, Surrey, United Kingdom

I worked on the game Dicey operations (<https://nrich.maths.org/games/dicey-operations>) NRICH primary live problem as part of the STEPS IN MATH program conducted by The GYM Foundation. Here is the scanned copy of my handwritten solution. I made a flow of steps based on the strategy I found by working on ten different number sets. Here are my flow of steps followed by in detail approach using ten number sets.



tens place
3 4
ones place
1 2

$$\begin{array}{r} 31 \\ 42 \\ \hline 73 \end{array}$$

tens place
2 2
ones place
4 2

$$\begin{array}{r} 84 \\ 20 \\ \hline 104 \end{array}$$

To 10. Also check the ones digits total. If there is a carry or choose tens digits total < 10

it's better to have the tens digit total < 10

ones place

$$\begin{array}{r} 8 9 \\ 6 8 \\ \hline 147 \end{array}$$

example

tens place
5 3
ones place
7 5

$$\begin{array}{r} 5 7 \\ 3 5 \\ \hline 8 2 \end{array}$$

example

$$3467$$

$$\begin{array}{r} 3 7 \\ + 6 4 \\ \hline 1 0 1 \end{array}$$

Possible tens digit total closer 10

$$\begin{array}{l} 3+4 = 7 \\ 3+6 = 9 \\ 3+7 = 10 \\ 4+6 = 10 \\ 4+7 = 11 \\ 6+7 = 13 \end{array}$$

ones digit

$$\begin{array}{l} \rightarrow 4+7 = 11 \\ \rightarrow 4+6 = 10 \\ \rightarrow 3+7 = 10 \\ \rightarrow 3+6 = 9 \end{array}$$

total

$$\begin{array}{l} \rightarrow 10 \\ \rightarrow 110 \\ \rightarrow 110 \\ \rightarrow 119 \end{array}$$

place the given digits to make the sum as close to 100 as possible.

How close can you get to the target?

How are you deciding where to put the digits?

Strategy to get the target on your first attempt.

I am going to start with a strategy

strategy 1:

I am going to choose two digits out of the four whose total are closest to ten. I'm gonna place them in the tens place and, I put the remaining digits in ones places. So I hope the tens place total closer to ten should give a total closer to 100.

number set one: 4500

I'm gonna put 4 and 5 in 10's and 0 and 0 in ones

$$\begin{array}{r} 50 \\ + 40 \\ \hline 90 \end{array}$$

yes it is closest sum to a 100. strategy 1 works

number set 2: 8401

I'm gonna put 8 and 1 in tens and 0 and 4 in ones

$$\begin{array}{r} 84 \\ + 10 \\ \hline 94 \end{array}$$

yes this is the closest sum to a 100

number set 3: 7355

I'm gonna put 7 and 3 and 5 and 5 in ones

$$\begin{array}{r} 75 \\ + 35 \\ \hline 110 \end{array}$$

No. It say I could of got a total more closer to 100. Then we need a another strategy.

What could have went wrong? The total of tens digit is 11 which is 1 more than ten this was because there was a carry over from ones digit total

this time I will put 5 and 5 in tens

$$\begin{array}{r} 57 \\ + 53 \\ \hline 110 \end{array}$$

the same thing happened a carryover from ones digit.

When there is a carry over in ones its a problem so I gonna try getting tens digit total less than ten

$$\begin{array}{r} 57 \\ + 35 \\ \hline 92 \end{array}$$

yes we got it total is as close to 100

number set 4: 7 6 5 4

I'll put card 5 in tens, card 6 in ones

$$\begin{array}{r} 1 \\ 57 \\ + 46 \\ \hline 103 \end{array}$$

yes it worked this is the closest to 100. now let's cheat a new strategy.

Strategy 2

I'm gonna take two digits and put them in tens place so when I add those numbers the total will be less than 100.

Let's try if this strategy works with new number sets.

number set 5: 7 6 8 9

1	1	7	6	8	9
68	78	87	97		
79	<u>96</u>	<u>69</u>	<u>68</u>		
<u>47</u>	<u>174</u>	<u>156</u>	<u>165</u>		

No. Strategy two doesn't work because 6 7 8 9 are so big you can't make the total less than ten. So Strategy

Strategy 3:

if all 4 digits are bigger than 5, the total of any two digits is going to be more than ten. so it's best to choose two of the smallest digits and put them in the tens place.

Now we have 3 strategies. let's combine all into one

Strategy 4:

I am gonna take two digits I'm gonna put them in the tens place so that the total comes closer to 100. But if the remaining two digits total in ones place have a carry over, I am gonna choose two

two digits got tens place which total is
larger than ten. So a carryover doesn't matter.
But if all the digits are bigger than 5 then choose
the two smallest digits so that the total is
as close as can be to 100.

Let's try the strategy out with a few number
sets

number set 6: 1 2 3 4

$$\begin{array}{r} 32 \\ 41 \\ \hline 73 \end{array}$$

(all digits are small
going to apply choosing 2 digits
that make a number closer
to 10 in the 10^s place)

yes we got it in the first attempt

number set 7: 9 5 3 1

$$\begin{array}{r} 95 \\ 13 \\ \hline 108 \end{array}$$

same as before worked again

number set 8: 7 6 5 3

$$\begin{array}{r} 65 \\ 37 \\ \hline 102 \end{array}$$

Oh I do close as
possible to 10 in 10^s place
than a carry over from unit place

(So I am gonna choose tens digit so
total less than 10)

yes it works

Number set 9: 8765

$$\begin{array}{r} 5 \ 8 \\ 6 \ 7 \\ \hline 12 \ 5 \end{array}$$

(cant make total of 10 in
10 digit)

(ones digit is gonna
have carry over)

(going to take two smallest
digits and put them in 10's)

yes it works

Number set 10: | 4 5 9

$$\begin{array}{r} 1 \quad 4 \\ + 9 \quad + 5 \\ \hline 10 \quad 9 \end{array}$$

two options to get total closer to 10 in tens place.

If 1 and 9 are in tens place then the total is exactly ten. And ones place will have 4 and 5 so there will be no carry over from ones digits.

If 4 and 5 are in tens place then total will be less than 10 and 9 and 1 will be in ones so there will be a carry over from ones digits.

in tens it best to get less than 10 total when there is a carry over in ones

$$\begin{array}{r} 94 \quad 49 \\ + 15 \quad + 51 \\ \hline 109 \quad 100 \end{array}$$

4 and 5 in tens worked 9 and 1 in ones

Worked

Let's compute all of the 10 number sets.

	4 Digits	Digits < 5	Digits >= 5	Strategy used
Set 1	4500	3	1	Make total less than 10
Set 2	8401	3	1	Make total less than 10
Set 3	7355	1	3	Make total less 10 with carry over
Set 4	7654	1	3	Make total less 10 with carry over
Set 5	7689	0	4	Put two smallest digits in tens
Set 6	1234	4	0	Make total less 10 no carry over
Set 7	9531	2	2	exact 10 no carry over
Set 8	7653	1	3	less 10 with carry over
Set 9	8765	0	4	two smallest in tens
Set 10	1459	2	2	less 10 with carry over

Strategy 5:

If all 4 Digits are more than 5 take both smallest numbers put them in tens the ones will always have a carry over. If 3 is less than 5 1 is more than 5 the total in tens should be less than ten. If 2 are more than 5 and 2 are more than 5 then if you can make less than 10 then do it. If it has to go over 10 then do it. If you can make less or make the going more than 80 less than 110. If 1 is less than 5 and 3 is less more than 5 then make total less than ten with carry over. If 4 is less and 0 is more make total with less than 10 no carry over