

Solution to Problem 1

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possible sums: 15, 16, 17, 18, 19, 20, 21, 22
note $6+7+8=21$

$\textcircled{6}$ $\textcircled{7}$ $\textcircled{8}$
 $\textcircled{?}$ $\textcircled{4}$ $\textcircled{9}$

try $?=0$
 $0+7+8=15$

try $?=9$
 $0+9+8=17$
 $6+9+8=23 \leftarrow \text{outside range}$

possible sums: 15, 16, 17, 18, 19, 20, 21, 22

try $?=0$

try $?=8$
 $0+8+8=16$
 $6+8+8=22$

try $?=7$
 $0+8+7=15$
 staying in range

$?+8+8=16$
 $?+7+8=14 \leftarrow \text{outside range}$

possible sums: 15, 16, 17, 18, 19, 20, 21, 22

try $?=1$ try $?=6 \Rightarrow ? \geq 8$ so try $?=9$

$?+8+8=16$
 can I get down to 15? can I get up to 22? get rest?

$?+8+8=15$ yes $6+7+9=22$ yes $6+8+8=22$

$6+8+9=23$

can't seem to make 18

possible sums: 15, 16, 17, 18, 19, 20, 21, 22

try $?=2$ try $?=5 \Rightarrow ? \geq 8$ so try $?=9$

$6+7+8=21$
 $?+7+8=17$
 $?+8+8=16$
 $?+7+9=18$
 $?+8+9=19$

$6+5+8=19$
 $6+4+9=19$
 $6+7+9=22$

front: $\textcircled{6}$ $\textcircled{7}$ $\textcircled{8}$
 Back: $\textcircled{2}$ $\textcircled{5}$ $\textcircled{9}$

we got it

Setting Up the Problem

The front face die shows 6, 7, 8. The back face die shows unknowns $?$, $*$, and $\spadesuit$.

Possible sums: 15, 16, 17, 18, 19, 20, 21, 22

Note: $6 + 7 + 8 = 21$

Trial: $? = 0$

$$0 + 7 + 8 = 15$$

Trial: $* = 9$

$$0 + 9 + 8 = 17$$

$$6 + 9 + 8 = 23 \quad (\text{outside range})$$

Possible sums: 15, 16, 17, 18, 19, 20, 21, 22

Trial: $? = 0$ (continued)

Trial: $* = 8$

$$0 + 8 + 8 = 16$$

$$6 + 8 + 8 = 22$$

Trial: $\spadesuit = 7$

$$0 + 8 + 7 = 15 \quad (\text{staying in range})$$

$$? + * + 8 = 16$$

$$? + 7 + \spadesuit = 14 \quad (\text{outside range})$$

Possible sums: 15, 16, 17, 18, 19, 20, 21, 22

Trial: $? = 1$

Try $* = 6 \Rightarrow \spadesuit \geq 8$, so try $\spadesuit = 9$.

$$? + * + \spadesuit = 16$$

Can I get down to 15? $? + * + 8 = 15$ yes

Can I get up to 22? $6 + 7 + \spadesuit = 23$ yes

Get rest? $6 + * + 8 = 20$

$$6 + * + \spadesuit = ?$$

Can't seem to make 18.

Possible sums: 15, 16, 17, 18, 19, 20, 21, 22

Trial: $? = 2$

Try $* = 5 \Rightarrow \spadesuit \geq 8$, so try $\spadesuit = 9$.

$$6 + 7 + 8 = 21$$

$$? + 7 + 8 = 17$$

$$? + * + 8 = 15$$

$$? + 7 + \spadesuit = 18$$

$$? + * + \spadesuit = 16$$

$$6 + * + 8 = 19$$

$$6 + * + \spadesuit = 20$$

$$6 + 7 + \spadesuit = 22$$

We got it!

Result

Front: 6, 7, 8 Back: 2, 5, 9