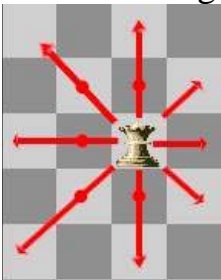


On a 4x4 chessboard with one queen in the corner (as above), how many legal ways are there to peacefully place (i.e. so that no piece can capture another piece) **2 more queens** on the chessboard?

Note: The legal moves are those defined by a game of chess.



Chess Answer: 8 ways

Counterfeit Coins

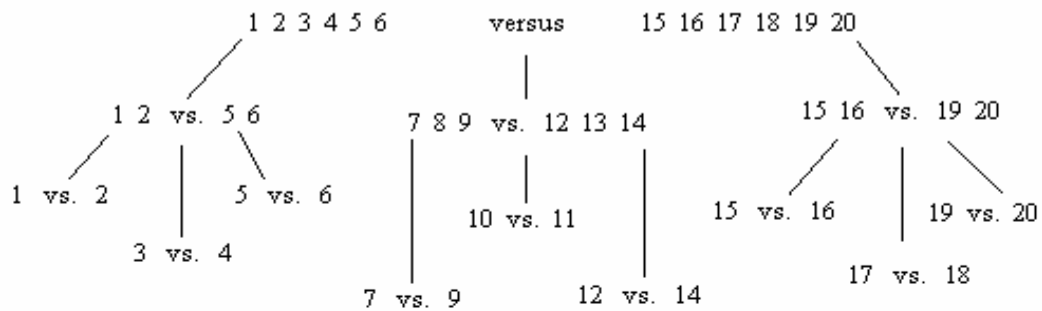
We have a group of 20 coins, one of which is a counterfeit coin. We know that the false coin is lighter than all of the other coins. Given a simple scale, what is the fewest number of weighings needed to determine which coin is fake?

Source:

Tucker, Alan. *Applied Combinatorics*. 4th edition. New York: Wiley, 2002.

Solution:

The minimum number of weighings needed to determine the fake coin is 3. Consider the tree below, in which we follow a “branch” if that side of the scale was lighter than the other. In all cases, it will take a maximum of three weighings to determine the false coin.



The Disappearing Dollar

Three men went to a motel to get a room. The clerk told them that the price of the room was \$30. Each man gave the clerk \$10 to pay for the room. Later the clerk realized he had overcharged the men and gave the bellhop \$5 to give back to the men. The bellhop decided that \$5 was too hard to divide equally among the three men so he gave each man \$1 and kept the other \$2. Each man originally paid \$10 and got \$1 back so they paid \$9 each. Three times \$9 is \$27 and the bellhop kept \$2.

Where did the other dollar go?

Citation:

<http://www.caveofknowledge.com/puzzles/puzzle5a.htm>

The Disappearing Dollar Solution

There really isn't a missing dollar. The riddle fools you into thinking that what the men **paid** plus what the bellhop **received** should equal \$30.

The three men paid \$27, the motel received \$25, and the bellhop received \$2. Total paid is \$27 ($\$9+\$9+\$9$) and the total received is \$27 ($\$25+\2). The books balance and there is no missing dollar.

It is only a coincidence that what the men paid plus what the bellhop received comes close to the original \$30 figure. Consider if the men had initially paid \$60 (\$20 each) for the room and the manager gave the bellhop \$35 to return to the men. The bellhop could have given each man \$10 back and kept \$5. Each man has now paid \$10 (\$30 total) the bellhop has \$5. $\$30+\$5=\$35$ and we see that now we're so far off from the original \$60 that you don't think to look for the "missing" \$25.

Grandfather's Age

My grandson is about as many days as my son is weeks,
and my grandson is as many months as I am in years. My
grandson, my son and I together are 100 years. How old am
I?

Answer: Grandfather is 60 years old.

From <http://www.braingle.com/brainteasers/teaser.php?id=1404&comm=1>

Integer Sequence

Complete the integer sequence.

1 11 21 1211 111221 _____

Hint: Think of how you would verbally describe the terms of the sequence that you know.

Source:

<http://www.people.virginia.edu/~rhp/Riddles/riddle8.htm>

Solution:

Here is the completed integer sequence.

1 11 21 1211 111221 312211 13112221 1113213211

The sequence is obtained by describing the previous term.

The first term is the single digit 1.

The second term describes the first term by indicating there is one 1 (11).

The third term describes the second term by indicating there are two 1s (21).

The fourth term describes the third term by indicating there is one 2 (12) and one 1 (11).

The fifth term describes the fourth term by indicating there is one 1 (11), one 2 (12), and 2 1s (21).

The sixth term describes the fifth term by indicating there are 3 1s (31), two 2s (22), and one 1 (11).

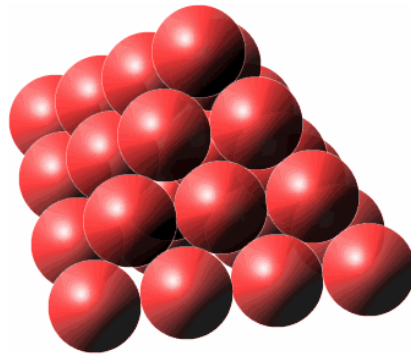
The seventh term describes the sixth term by indicating there is one 3 (13), one 1 (11), two 2s (22), and two 1s (21).

The eighth term describes the seventh term by indicating there is one 1 (11), one 3 (13), two 1s (21), three 2s (32), and one 1 (11).

Ping-Pong Pyramids

Ping-pong balls are stacked in the shape of a complete pyramid. Each triangular-shaped layer has equal numbers of ping-pong balls on each side. A 4-layer display is shown. What is the total number of ping-pong balls necessary to make a 7-layer complete pyramid?

Note: The pyramid is filled with the maximum number of ping-pong balls.



Ping-Pong Ball Answer: 140 ping-pong balls

Confer: <http://www.youngsaintlouis.com/archive/May2002/kids/mathanswers.html>

A classic puzzle, and very applicable to many college students today:

$$\begin{array}{r} \text{SEND} \\ + \text{MORE} \\ \hline \text{MONEY} \end{array}$$

Replace the Letters above, just as you would variables, so that a valid sum is obtained. You may use each integer 0 through 9 only once. Then take the sum represented by "MONEY", divide by 2, and subtract _____. This is the room number that contains your next clue!

Solution:

$$\text{SEND} = 9567$$

$$\text{MORE} = 1085$$

$$\text{MONEY} = 10652$$

Confer: *Math Horizons*, April 2006, pg. 13

4			7		1		E	6
7	2	K					8	9
L		6	D			5		
	9		1		5		6	
	B		9	3	8			J
C	7		6	H	4	A	5	
		7				6		
1	3						4	8
6	I		2	G	3		F	5

Being good at Su Doku might be to your advantage here... The letters above represent variables, so when the grid is filled in each letter will have a corresponding value. Then fill them in below to get the number of the next room in Chambers you must visit:

$$A + F + D \pmod{10} = W$$

$$B + I + L \pmod{6} = X$$

$$K + H + G \pmod{3} = Y$$

$$E + C + J \pmod{4} = Z$$

Hurry over to room WXYZ !!!!!

Answer:

$$A = 9$$

$$B = 6$$

$$C = 8$$

$$D = 3$$

$$E = 2$$

$$F = 9$$

$$G = 1$$

$$H = 2$$

$$I = 4$$

$$J = 7$$

$$K = 3$$

$$L = 9$$

So $A + F + D = 21$

$$B + I + L = 19$$

$$K + H + G = 6$$

$$E + C + J = 17$$

Sum the Series:

$$\sum_{n=1}^{2005} \frac{\log n}{\log(2006n - n^2)}$$

Sum the series: 1002.5

Hint: Find the first few terms and last few terms (e.g. $n = 1, 2, 3, 2003, 2004,$ and 2005). See if you notice what's happening.

Also, observe the value when $n = 1003$.

Water Challenge

- You've got a 3 liter jug and a 5 liter jug.
- You've got a pool of water.
- What is the fewest number of steps it takes to come up with exactly 4 liters of water?

No, you cannot pour some water into the 5 liter jug and then guess. Nor can you fill each jug up half way or something. You have to be exact. A step is defined as putting water into a jug (not emptying). For instance, filling the 3 liter jug and then pouring it into the 5 liter jug is 2 steps.

Die Hard Problem Answer: 6 steps

Solution: They have to use a 3 gallon jug and 5 gallon jug to put exactly 4 gallons of water onto a scales. They do it by pouring 3 gallons from the 5 gallon jug leaving 2 gallons of water in the 5 gallon jug. Then they empty the 3 gallon jug and pour the 2 gallons into it, which leaves 1 gallon of empty space. They fill the 5 gallon jug and fill the space in the 3 gallon jug, leaving exactly 4 gallons.

Adapted from <http://256.com/gray/teasers/#jugs>