This question requires you to use answers from three problems:

Problem (1)

$$\begin{pmatrix} 7 & 2 & 8 & 9 & 8 & 4 & 3 & 8 \\ 3 & 7 & 4 & 1 & 9 & 0 & 7 & 1 \\ 2 & 1 & 1 & 0 & 2 & 7 & 1 & 7 \\ 2 & 0 & 3 & A & B & C & 1 & 6 \end{pmatrix}$$

There are three numbers missing above, can you figure out what they should be? After you have them, enter them into the answer sheet.

Problem (2)

	8273	9146	6437
	1955	5555	2846
X	4655	9362	7382
	3728	7319	5591
		Y	

One of the numbers above does not quite fit in with the rest. Identify this number, and then its coordinates can be put into the answer sheet.

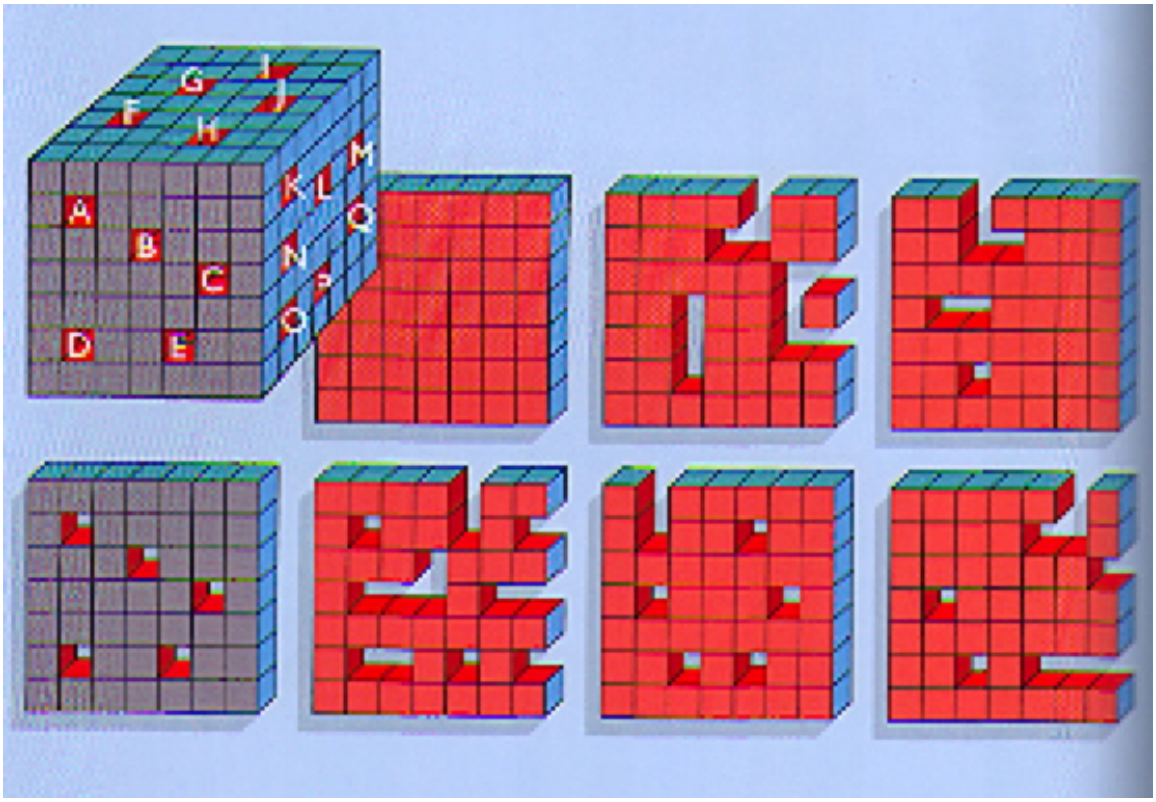
8273 = (1,1)

1955 = (2,1)

…

_____= (X,Y)

Problem (3)



In the picture above, the cube has 7 tunnels through it, (with different entrances and exits), and 3 recesses with only 1 entrance. According to the lexicon below, find the starting points of the three recesses, convert them their respective number, add them together, and you will have the last part of this clue. Good Luck!

A = 1	I = 9	Q = 17
B = 2	J = 10	
C = 3	K = 11	
D = 4	L = 12	___+___+___ = Z
E = 5	M = 13	
F = 6	N = 14	
G = 7	O = 15	
H = 8	P = 16	

Answer Sheet

For your next clue/puzzle…

…go to RM #
(|A|+|B|+|C|)*(|X|+|Y|+|Z|) + (this is where we adjust)

Answers:

A = 0
B = 9
C = 1
X = 3
Y = 2
Z = 11 + 12 + 15

Kids Ages

At a party you overhear another guest asking the age of the hosts' 3 children. The host tells the guest that the product of his kids' ages is 72 and the sum of their ages is the same as the guest's house number. Now, the other guest obviously knows her own house number but, after thinking for a bit, she is forced to ask the host for additional information. The host then says that his oldest child likes strawberry ice cream and the other guest is able to say their ages. Even though you don't know the guest's house number, you have enough information.

Assuming that all of the ages are whole numbers (1, 2, 3 *not* 2 1/2), How old is his oldest child?

Hint:
First factor 72. $72 = 1 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$.

Combine these factors into 3 ages. You should find 11 combinations of the factors of 72. For example (1 2 36), (1 3 24), (1 4 18), (1 6 12), …

The host says that their sum is equal to the house number of the guest. Now the guest knows his house number but is still unable to find the ages of the children. It is necessary to know the oldest child of the host liking strawberry ice cream to answer the question.

Answer: 8 years old

This is much like Student Ages question although a bit easier. You first must factor 72 which breaks down into 1x2x2x2x3x3. Combining these numbers to make 3 ages reveals 11 combinations: (1 2 36), (1 3 24), (1 4 18), (1 6 12), (1 8 9), (2 2 18), (2 3 12), (2 4 9), (2 6 6), (3 3 8), and (3 4 6).

The host says that their sum is equal to the house number of the guest. If the guest has to ask for more information then some of the combinations must add up to the same number. By adding up all of the combinations, we find that (2 6 6) and (3 3 8) both add up to 14 so the house number must be 14 and one of the combinations must be correct.

But the guest is unable to get the answer. Then the host says that the oldest likes strawberry ice-cream which tells you that there *is* an oldest. Since (2 6 6) implies that two of his children have the same age, the answer must be (3 3 8).

From http://256.com/gray/teasers/#kids_ages.

How OLD is that professor??

You overhear a conversation between a professor and his teaching assistant. They are talking about a course they are running with just three students.

- **Professor: The product of the ages of the students in our class is 2450 and the sum of their ages is twice your age. Can you tell me how old they are?**
- **Assistant: (After thinking for a little while) No.**
- **Professor: I'll let you in on a secret. I am older than all of them, and now you can answer the question.**
- **Assistant: (Even though he does not know how old the professor is, he thinks for a bit, smiles, and says) Yes I can.**

The question *is* worded correctly and the professor's "secret" mentioned above is important. Given that all of the ages involved are integers (whole numbers), how old is the professor?

Hint:

Factor 2450. $2450 = 1 \cdot 2 \cdot 5 \cdot 5 \cdot 7 \cdot 7$

Combine these numbers to make 3 ages. You should find 20 combinations (for example (1 1 2450), (1 2 1225), ..., (7 10 35), and (7 14 25).

Now the assistant obviously knows his own age, but still can't figure out the ages of the students. Once the professor reveals his age, the assistant and you can answer the question.

Answer: Professor is 50

First you must factor 2450. It breaks down into 1x2x5x5x7x7. Combining these numbers to make 3 ages reveals 20 different combinations: (1 1 2450), (1 2 1225), ..., (7 10 35), and (7 14 25). Now the assistant obviously knows his own age but can't figure out the ages of the students. This implies that multiple sets of factors add up to the same value. The sets (5 10 49) and (7 7 50) both have a sum of 64.

Then the professor reveals that he is older than all of the students, and says that we now can answer the question. If he was 51 or older we would not be able to figure out which set of factors is correct, so he must be 50 years old and the student ages must be 5, 10, and 49.

From http://256.com/gray/teasers/#students.

Word Rearrangements

How many ways are there to arrange the word "SYSTEMATIC" so that each S is followed by a vowel (including Y)?

Source:

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

Solution

4 x 3 x P(8,6) = 241920

(4 ways to assign a vowel to follow the first "S", 3 ways to assign a vowel to follow the second "S"; note that because the S's aren't distinct, this is double-counting some pairs. Then if we consider these pairs as single characters, we have a total of 8 objects, 6 of which – the non-pairs – we need to place. The double counting is canceled out by the fact that we will have two ways to insert the pairs into the permutation.)

XKTVDIIDVT
IGXSDUIWTBJGSTG
LTPEDCQTUD
GTPCNDCTUXCSHDJ
ILWPIXKTSD
CTXZCDLIWPIXCPB
PITGDUWDJG
HIWTEDAXRTLXAAQ

TDCBNIGPXA
WJCIXCVBTSDLCA
XZTPSDVQJI
LWTGTIDWXSTIWTI
WXCVXZCDLX
AAEAPRTXIXCIWTG
DDBCPBTSPU
ITGIWTCDCRNRAXR

VGDJEDUDGS
TGUDJGQNIWTRDBE
JITGBPNVDS
UDGVXKTBTUDGLWP
IXKTSDCT

Decipher this if you can! It's the last one, and if you need a hint come up and ask up at headquarters.

Answer:

Ive got to get rid of the murder weapon before anyone finds out what ive done. I know that in a matter of hours the police will be on my trail, hunting me down like a dog. But where to hide the thing. I know, I'll place it in the room named after the non-cyclic group of order four, by the computer. May God forgive me for what Ive done.

Here's the shift used:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O

[Editor's note: There was a calculus book (i.e. the murder weapon) hidden in the room described above. (FYI, it was the Klein classroom, named in honor of a wonderful math professor.) You will have to change that part of the cipher unless you too have a Klein classroom. But you get the idea.]