Puzzle 0

In my dreams I heard my toy cry, "−… .−.. .. −. −.." (no period to this sentence.)
Then they began singing first in man's voice then in some unearthly language,
"My life is trapped in three rows;
Ieees
I, ee
I
E

H,
Eei
E
E

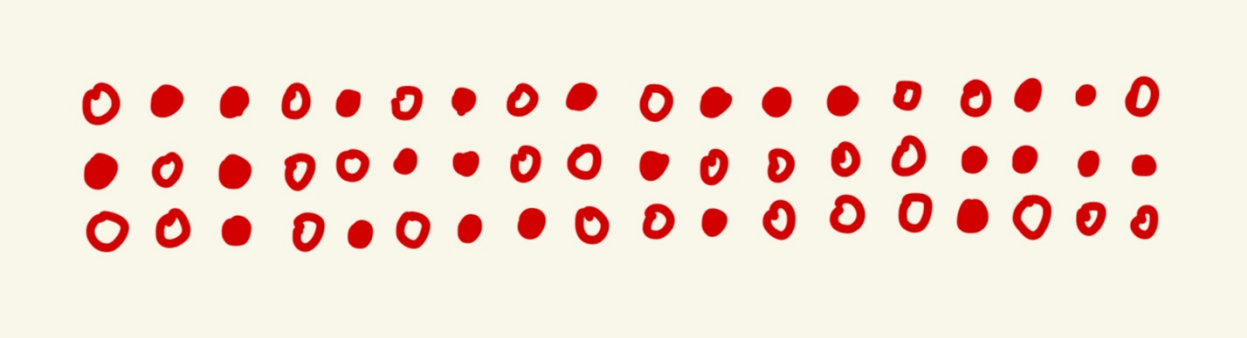
."
What is he saying?

Answer: I love math.

First, the morse code deciphers into the word "BLIND," (not "BLFD," a common mistake many people have made.) Next, what will you think of when you see the word "blind"? Perhaps the written language blind people use? Yes, braille. Next we translate the letters into the morse code:

I: ..
E: .
S: …
H: ….

In the short poem, we arrange the morse code translations into three rows according to the sequence they appear in the poem. Call the translated rows the braille map. When we change lines in the poem, we assign two blank dots to the braille map. When we include a comma in the poem, we change lines in the braille map. Observe that there is a blank at the beginning of the poem. We need to assign a blank dot to the start of the line. We do not need to take into account of the spaces between words in the poem. Here is the rearranged map:



It reads out to be: I love math.

Puzzle 1

Repollo (CABBAGE)

DBC1C1BAF1

What is the next line?

Answer: EC1D1D1C1BG1.

Repollo is Spanish for CABBAGE. Hey, there's something special about this word, isn't there? All the letters in CABBAGE can be read in terms of musical notes: C, A, B, G, E. Now the next line DBC1C1BAF1 is a transposition of the original rhythm. From then we could derive the third: ECD1D1C1BG1.

Puzzle 2

Your garden seems to be telling you something:

“yzqnux are perfect and deep love.

Kqtbjwx are technically the reproductive portion of any plant.

Cdqjr carries water and minerals.

Cjwtumdyj needs very little water.

The sjwi that made this puzzle ran out of biology facts.

The ujyfqx of a flower are modified leaves that surround the reproductive parts of flowers.

Xhnjshj is fun.”

Answer: Passion.

All the strings of letters could be deciphered using the clues. The translated poem is:

“tulips are perfect and deep love.

Flowers are technically the reproductive portion of any plant.

Xylem carries water and minerals.

Xerophytes needs very little water.

The nerd that made this puzzle ran out of biology facts.

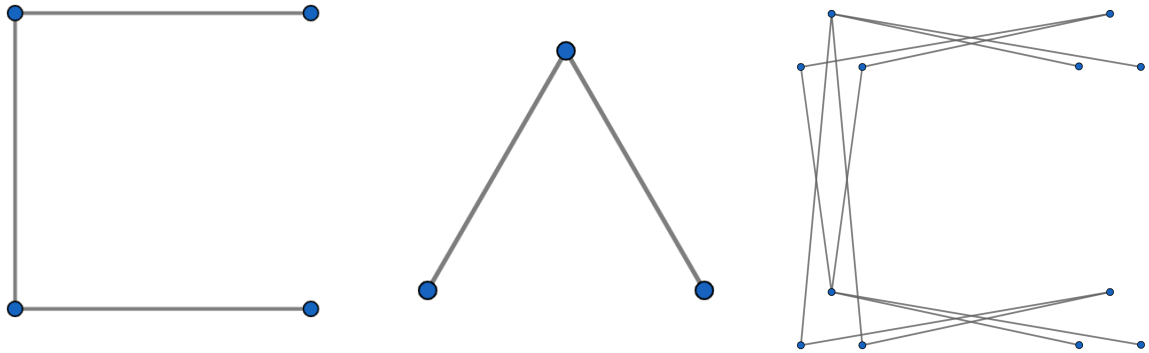
The petals of a flower are modified leaves that surround the reproductive parts of flowers.

Science is fun.”

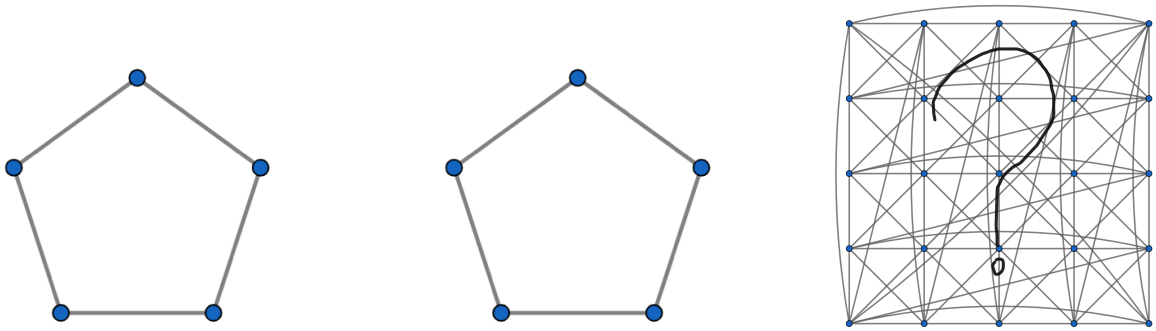
All these translated words are encoded with Caesar key 5. We are to extract a letter from each of these words and again encode them with the Caesar key 5. Those letters are: u,f,x,x,n,t,s. That translates into “passion”.

Puzzle 3

Mathematicians and physicists are mutual friends. However, engineers get along with neither. (Bazinga!) We also know that ballerinas only get along with musicians and basketball players, hockey players only get along with basketball players, and musicians only get along with ballerinas. Now do you get a clue to what the graphs below are illustrating?



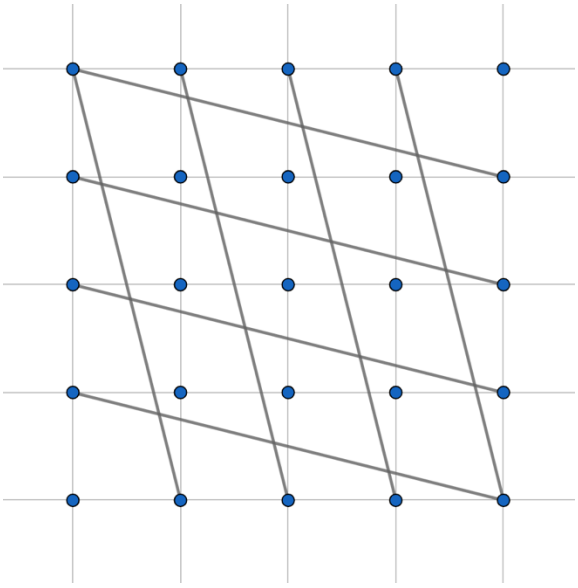
Can you derive the missing parts of the rightmost graph below if we are dealing with five occupations and five hobbies, as indicated by the first two graphs?



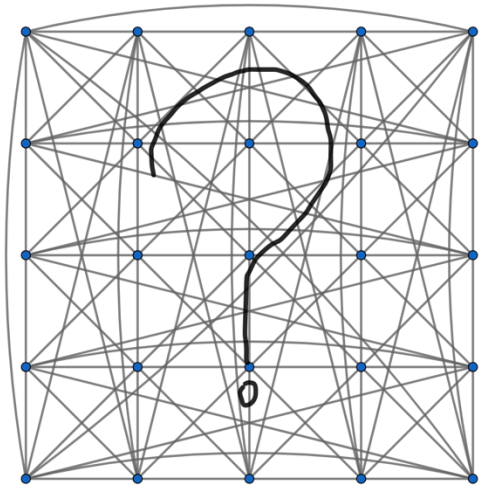
Note: "Bazinga!" is a catchphrase used in the TV show "The Big Bang Theory" and does not have a direct translation.

Answer:

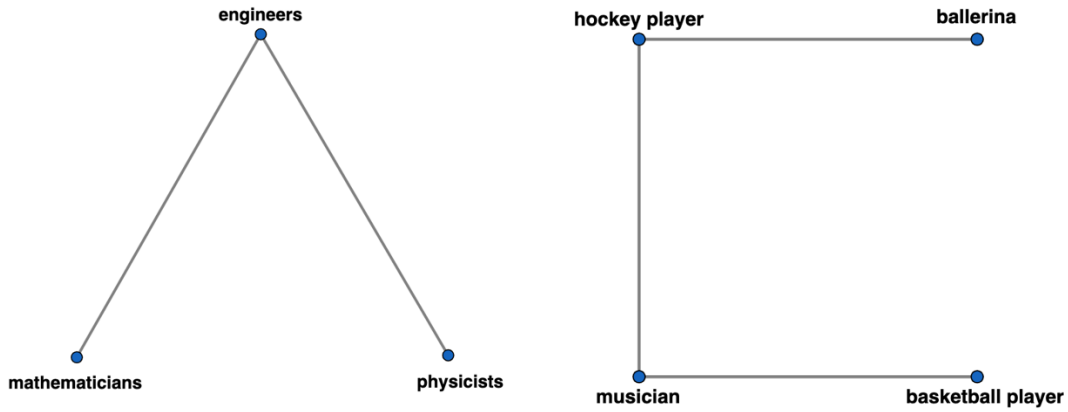
Missing graph:



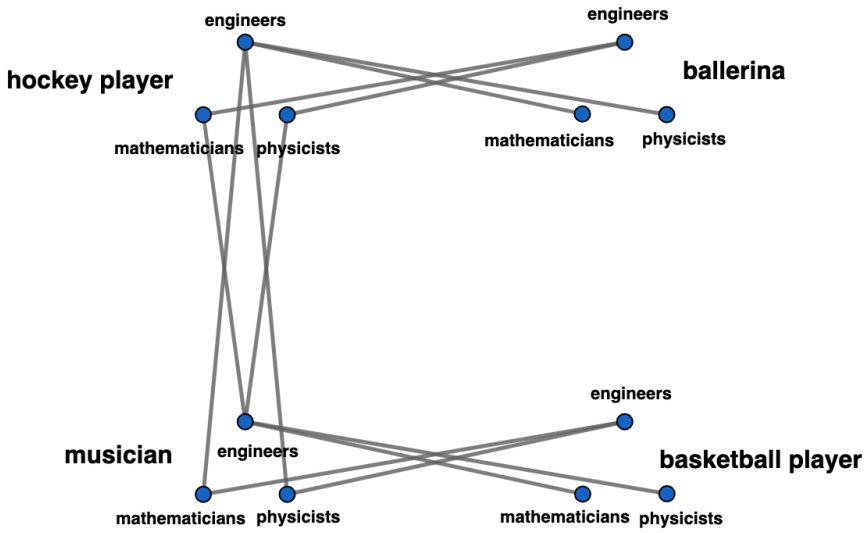
Complete graph:



Here is the filled−out graph using the clues given (basically vertices stand for occupations/hobbies and two vertices are adjacent if and only if the two people don't get along):



Now what do we mean by combining these graphs? We allow $3 \times 4 = 12$ combinations of occupations and hobbies; that is, there could be mathematicians that play a musical instrument, or engineers that play ice hockey. Now, people tend to have more in common: as long as either of their hobbies or occupations match, they get along. We put this into a new graph that somewhat preserves the original structure and then insert edges accordingly.



We could use a similar logic for the two graphs C_5. One could also extract an abstract definition of tensor graphs $G_1 \times G_2$ accordingly: given two graphs $G_1 = (V_1, E_1)$ and $G_2 = (V_2, E_2)$, define $V_1 \times V_2 = \{(u_1, u_2) : u_1 \in V_1, u_2 \in V_2\}$, with $(u_1, u_2) \neq (v_1, v_2)$ connected if and only if $u_i v_i \in E_i$ for $i = 1,2$. We could derive the answer to the puzzle from this given definition.

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Puzzle 4 (META puzzle! DO NOT DISTRIBUTE UNTIL THE INDIVIDUAL SOLVES AT LEAST TWO SMALL PUZZLES!)

On a five−by−five integer lattice grid obtained from Puzzle 3 I place ABCDE on top, and place them in reverse order at the bottom. I put B1C1D1 downwards sandwiched in between on the left side, and place them in reverse order on the other. I start painting, with few clues obtained from a very familiar melody. I soar high and traverse the furthest distance the melody leads me to. Ground 1 is in the middle, a voice says. I land and gaze at my trajectory.

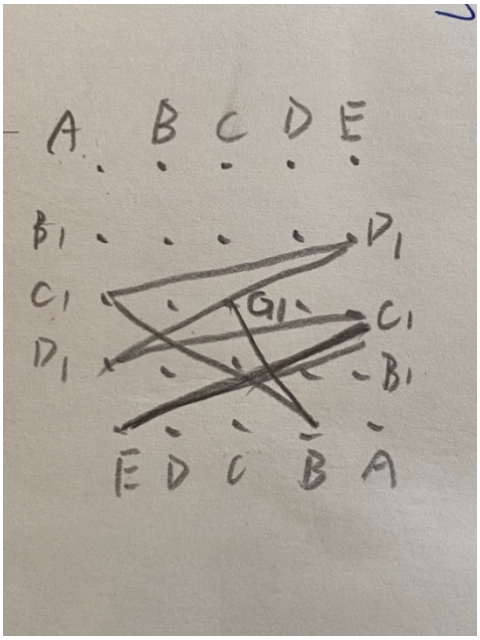
1. What is it like?

Next, I want to arrange the paper in a way that the two groups of sloped lines each meet in a circular shape.

2. What is the ultimate thing that I will get?

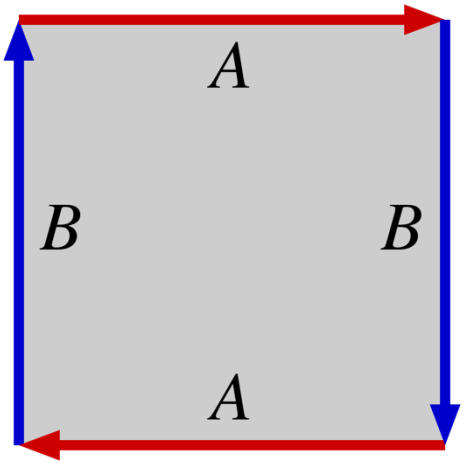
Answer:

1.



2. Real Projective Plane

The answer to question 1 is kind of straightforward so we will leave the graph here for the readers to interpret them. For question 2, notice that the respective letters are reversely−placed on two parallel lines. This inspires us to think of gluing diagrams in general topology. A gluing diagram of this form would correspond to the *real projective plane*.


A
B
B
A