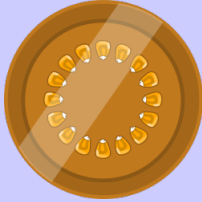*2019*
Beaver
Computing
Challenge
(Grade 9 & 10)

Questions

Beaver Coins

Story

Beavers use coins with the following values:
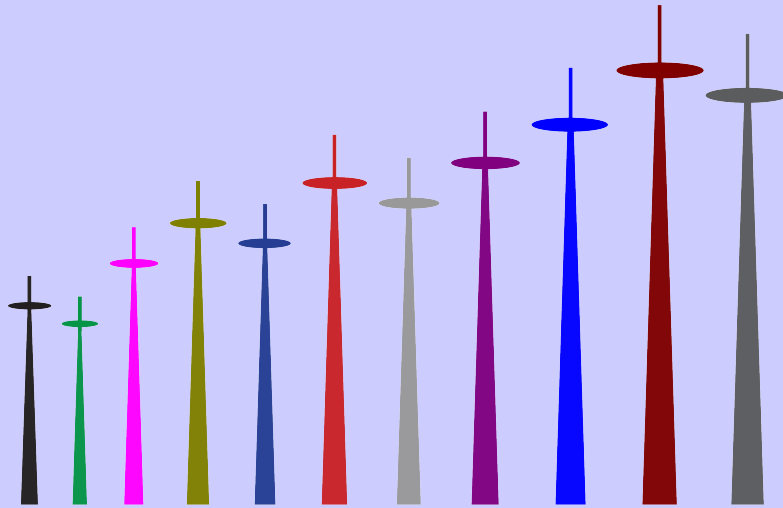

16   8   4   2   1

Question

Which of the following total values can be made using exactly three coins?

(A) 23

(B) 2

(C) 38

(D) 13

Special Towers

Consider the towers shown.

A tower is *special* if all towers to the left of it are shorter, and all towers to the right of it are taller.
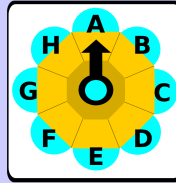
Question

How many special towers are there?

(A) 1

(B) 2

(C) 3

(D) 4

Safe

Story

A chef keeps secret recipes in a safe. It is unlocked using a circular knob with a pointer.

With the pointer at A to start, the chef unlocks the safe by turning the knob clockwise and counter-clockwise alternately as the password is spelled. For example, to enter the password BH, the chef:

turns one position clockwise	then turns two positions counter-clockwise

We represent passwords using numbers to indicate how far to turn and arrows to show the direction. For example, BH is represented by $1\circlearrowright\ 2\circlearrowleft$ which means turn one position clockwise and then two positions counter-clockwise.

To retrieve the secret recipes, the chef must enter the password CHEFDG.

Question

With the pointer starting at A, which of the following will unlock the safe?

(A) $2\circlearrowright\ 3\circlearrowleft\ 4\circlearrowright\ 3\circlearrowleft\ 3\circlearrowright\ 3\circlearrowleft$

(B) $2\circlearrowright\ 5\circlearrowleft\ 5\circlearrowright\ 1\circlearrowleft\ 3\circlearrowright\ 3\circlearrowleft$

(C) $2\circlearrowright\ 3\circlearrowleft\ 5\circlearrowright\ 7\circlearrowleft\ 6\circlearrowright\ 5\circlearrowleft$

(D) $2\circlearrowright\ 1\circlearrowleft\ 4\circlearrowright\ 3\circlearrowleft\ 3\circlearrowright\ 2\circlearrowleft$
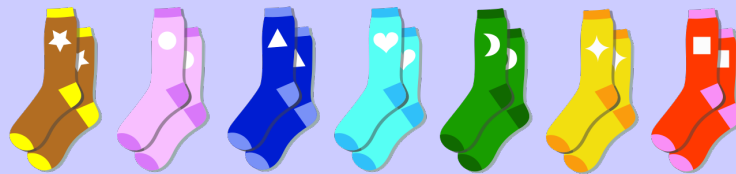
Socks

Story

Anil likes to vary the colour of socks he wears. He keeps all of his socks arranged in a line and follows the rules given below to choose a pair of socks for the day.
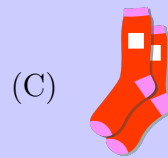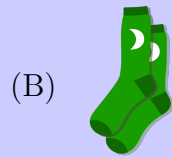
- Socks to be worn are always taken from the right end of the line.
- Socks are washed right after they are worn, and are then added to the left end of the line.

On the morning of November 18, Anil wakes up and sees the following line of socks.

Question

Which pair of socks will Anil wear on November 28?

(A)   (B)   (C)   (D)

Language Detection

Story

Explorers stumble across the following ancient list of five words on the wall of a cave.

paqroob   *puue*   *t'seqrub*   *meoub*   *lai'laiqy*

The explorers use a system to try and determine which language each word is from.

- Each word is given an initial score of 10.

- The score is adjusted using the following rules:

starts with p	-2
ends with b	-2
more than 6 characters	$+3$
has q followed immediately by r or y	-4
has three vowels (a, e, i, o, u) in a row	$+5$
contains an apostrophe (')	$+1$

- If the final score is 10 or greater, the system classifies the word as Beaverish.

- Otherwise, the system classifies the word as Beaverian.

For example, the word *palliob* is given a score of $10-2-2+3+0+0+0 = 9$ and so the system classifies *palliob* as Beaverian.

Question

Using this system, how many of the five words from the cave are classified as Beaverish?

(A) 2

(B) 3

(C) 4

(D) 5

Celebrity

Story

Members of a social network may follow other members. Within a group of members, a particular member is called a *celebrity* if they are someone who

- is followed by everyone in the group, and

- does not follow anyone in the group.

Question

What is the maximum possible number of celebrities in a group of five members?

(A) 0

(B) 1

(C) 2

(D) 5

Cancelled Flights

Story

The dashed lines in the diagram represent all Bebras Air flights. Each flight operates in both directions. The airline is popular because its customers are able to fly between any two cities (possibly stopping in one or more cities in between).

Moscow

Washington,D.C.

New York London Paris Kuala Lumpur

San Francisco

Cairo
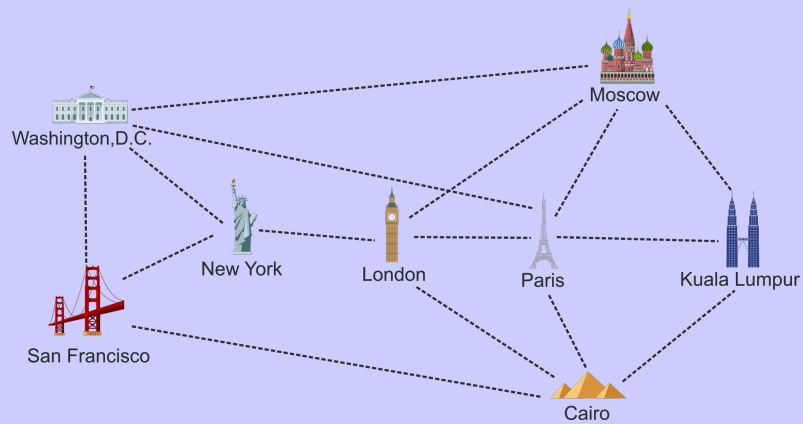
The airline wants to cancel some flights but it still wants its customers to be able to fly between any two cities.
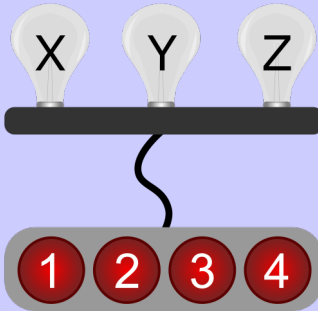
Question

What is the maximum number of flights that Bebras Air can cancel?

(A) 6

(B) 7

(C) 8

(D) 9

Light Buttons

Story

There are three light bulbs, labelled X, Y, and Z, which can be turned on and off using four buttons numbered 1, 2, 3, and 4. Each button produces a different action when pressed as described below.

Button	Action
1	turn on bulb Y and turn off bulb X
2	turn on bulbs X and Y and turn off bulb Z
3	turn on bulb Z and turn off bulb Y
4	turn on bulb X

If a button attempts to turn a particular light bulb on that is already on, then that light bulb will remain on. Similarly, if a button attempts to turn a particular light bulb off that is already off, then that light bulb will remain off.

All three light bulbs are currently off. You want them all on after pressing a sequence of buttons.

Question

Which of the following sequences should you use?

(A) 2 , 3 , 1

(B) 2 , 3 , 4

(C) 4 , 1 , 3

(D) 3 , 1 , 4

Story

Given an image of an animal, a machine measures various parts of the animal: head, ears, and whiskers. The height of a part is the distance from its lowest point to its highest point. The width of a part is the distance from its leftmost point to its rightmost point.

These measurements are used to identify the animal based on the chart shown.

	Rabbit	Beaver	Bear	Cat
ear height	$\frac{1}{2}$ of head height	$\frac{1}{4}$ of head height	$\frac{1}{4}$ of head height	$\frac{1}{2}$ of head height
whiskers width	head width	$\frac{1}{2}$ of head width	$\frac{1}{2}$ of head width	head width
head width	$\frac{1}{2}$ of head height	$\frac{1}{2}$ of head height	head height	head height

Question

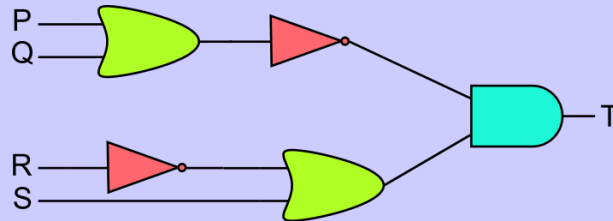What type of animal does the machine identify the following image as?
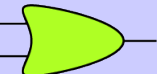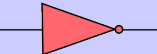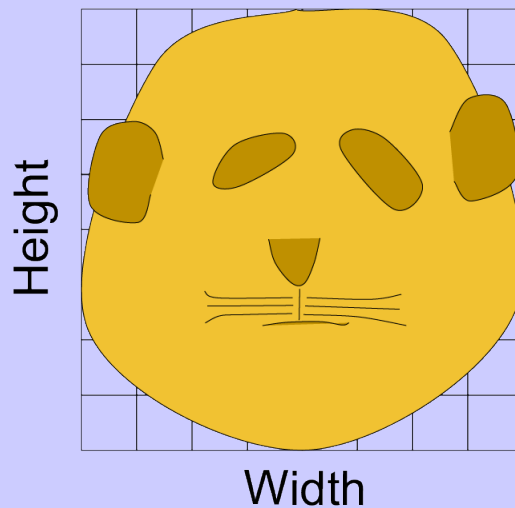

(A) Rabbit

(B) Beaver

(C) Bear

(D) Cat

Story

An escape room uses the following design for the inner-workings of a lock. The lock is made using nine rods and five blocks.

Each rod turns like a key either clockwise or counter-clockwise. Each block has one or two input rods coming in from the left and one output rod coming out to the right. The table below describes how input rods and the type of block determine how output rods turn.

|	
	If both input rods are turned clockwise, then the output rod will turn clockwise. Otherwise, the output rod will turn counter-clockwise.
	If both input rods are turned counter-clockwise, then the output rod will turn counter-clockwise. Otherwise, the output rod will turn clockwise.
	The output rod will turn in the opposite direction as the input rod.

Question

Each input rod at P, Q, R, and S is turned once causing the output rod at T to turn clockwise. How might have the input rods been turned?

	P	Q	R	S
(A)	clockwise	clockwise	counter-clockwise	clockwise
(B)	counter-clockwise	counter-clockwise	counter-clockwise	clockwise
(C)	clockwise	counter-clockwise	counter-clockwise	clockwise
(D)	counter-clockwise	counter-clockwise	clockwise	counter-clockwise

Coins and Monsters

Story

Tara starts in the lower left corner of the map shown. She can only move up or to the right as she makes her way to her home in the upper right corner.
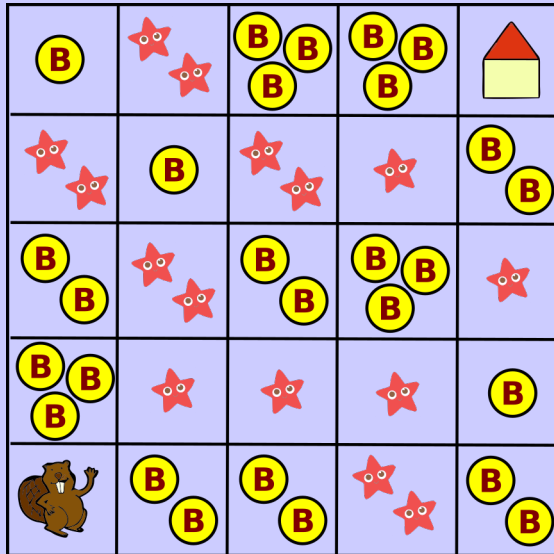
Each square along the way contains either monsters, or coins (B). Tara collects all the coins along the path she follows. When she enters a square with monsters, she must give one coin to each monster in that square.

Question

If Tara starts with 10 coins, what is the maximum possible number of coins she could have with her when she arrives home?

(A) 18

(B) 19

(C) 20

(D) 22

Aircraft Scheduling

Story

When an aircraft lands at an airport, it is assigned a designated airspace called a *corridor*. By ensuring that flights with similar landing times are in different corridors, air traffic controllers can help to avoid accidents.

At the Bebrasland airport, two aircraft cannot have the same corridor if their landing times are within 15 minutes of each other.

For example, if Flight #1 lands at 6:07 a.m., Flight #2 lands at 6:10 a.m., and Flight #3 lands at 6:25 a.m., then Flights #1 and #2 cannot be assigned the same corridor and Flights #2 and #3 cannot be assigned the same corridor. However, Flights #1 and #3 could be assigned the same corridor.

You are the Air Traffic Controller at the airport and your job is to assign corridors for the flights that are due to land at the times shown in the table.

| Flight	Time
9W2400	7:00 a.m.
9W1321	7:21 a.m.
AI561	7:20 a.m.
AI620	7:18 a.m.
EK427	7:03 a.m.
SG147	7:12 a.m.

Question

What is the minimum number of corridors needed to ensure that the flights in the above table are assigned corridors according to the rules at the Bebrasland airport?

(A) 2

(B) 3

(C) 4

(D) 5

Buying Shoes

Story

A beaver would like to buy a pair of shoes imported from Triušisland. The shopkeeper tells the beaver that the shoes are arranged in a 7×7 grid so that in each row all shoes have the same length and different widths, and in each column, all shoes have the same width and different lengths. The shoes in each row are arranged from narrowest to widest going from left to right, and the shoes in each column are arranged from longest to shortest going from top to bottom.
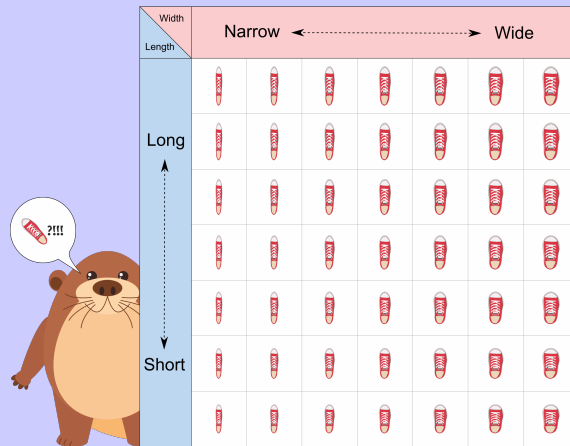
The beaver is unfamiliar with the shoe sizes of Triušisland. However, by trying on a pair of shoes, the beaver can tell if the shoes are too wide, too narrow, or the correct width, as well as if they are too long, too short, or the correct length. A shoe *fits* if it is both the correct length and correct width.

The shopkeeper says:

> "No matter what your shoe size is, I guarantee that there is a pair of shoes that fits you and a pair that fits can be identified by trying on no more than n pairs of shoes. You might not even have to try on a particular pair of shoes to know that it fits!"
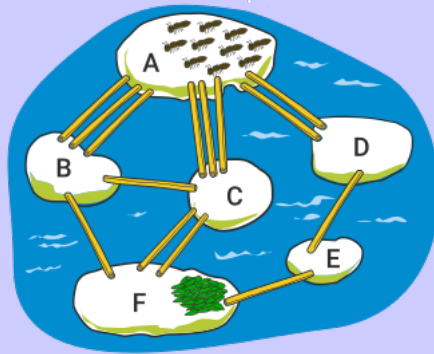
Question

Assuming the shopkeeper is correct, what is the smallest possible value of n?

(A) 2

(B) 3

(C) 4

(D) 5

Ants in a Swamp

Story

Ten ants are located on Stone A and seek to reach the food on Stone F.

The ants can only travel between the stones by walking along the straws joining the stones. No two ants can be on the same straw at the same time. It takes each ant 1 minute to travel from a stone to any other stone connected to it by a straw.
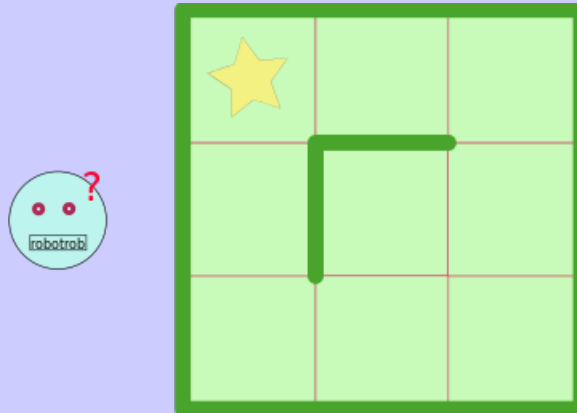
Question

What is the maximum number of ants that can reach the food on Stone F after 3 minutes?

(A) 6

(B) 7

(C) 8

(D) 9

Recover My Robot

Story

Natasha lost her robot but she knows that it is in one of the nine squares in the following 3×3 grid.

Natasha can remotely send a sequence of commands to the robot. She can command it to move one square UP, LEFT, RIGHT, or DOWN. The robot will not move if there is a wall in the way. For example, if the robot is in the centre square and is told to move LEFT, it will ignore that command and move on to the next command. The walls are drawn on the picture by a thick (green) line.

Question

Which of the following sequences of commands guarantees that the robot will reach the square marked with a star no matter where the robot begins?

(A) UP - UP - LEFT - LEFT - UP

(B) RIGHT - UP - UP - LEFT - LEFT

(C) DOWN - LEFT - LEFT - UP - UP

(D) UP - RIGHT - UP - LEFT - LEFT