TI-CONCOURS 2013

z80 TI-Basic category
Final, programming test

May 18th - 19th, 2013

Time: 3 hours
Coefficient: 4

Brave new world

Before starting

You have three hours to make the eight programs that are requested , plus thirty minutes to send your programs at the address ticoncours@aol.com. In this email you will indicate your nickname, your personal code, the relevant category and you join a. zip file or. rar file named TZEMXX with your personal code instead of XX. If you exceed the time limit, you will get a penalty point per started minute of delay (out of 400 points).

Reference letter of the test is the letter M: thus, each program will be called MXXQN with your personal code instead of XX, and the question number instead of N. For example, in question 3 the candidate whose personal code is 42 will create a program called M42Q3. Subprograms are not allowed.

Each question is assigned a level of difficulty: easy, medium or hard. Difficult questions are obviously supposed to ask you to think a little more about it, but beware that an easy or difficult issue from our point of view will not be necessarily perceived in the same manner at home, in front of your screen.

The scale will not be revealed. Be aware however that the goal is to create programs that are rigorous, optimized and efficient, not esthetic (at least in this category). To make things easier, it is assumed that the user knows how the programs, and never commit an input error.

Good luck to all the finalists!

Brave new world

We are in the year 2337. Since long time ago all human beings live under the surface of the Earth. Now the human race is divided into two castes: the upper caste, which lives on the ceiling, and the lower caste, which lives on the ground. The membership of a newborn baby to any caste is decided at birth, according to the gravity it undergoes naturally, and is definitive, from the birth, the baby is being raised with those of his caste, away from those who live "in the other direction." The Code of BiDirectional Humanity (or CBDH) requires each caste have no relationship with each other, whether friendly or conflictual.
Paul and Julie are both 20 years old. He belongs to the lower caste, she from the upper caste. Paul loves Julie, Julie loves Paul. An illicit love, which could bring them to jail if it was discovered. But Paul and Julie are unconventional young people...

Question 1 (easy)

Make a program that asks the user a matrix [A] and "exercises" the gravity on the "objects", represented by non-zero digits in the matrix.

Example:

$$
\begin{matrix}[[0, 2,0] \\ [1, 4, 0] \\ [0, 0, 1]]\end{matrix} \quad => \quad \begin{matrix}[[0, 0, 0] \\ [0, 2, 0] \\ [1, 4, 1]]\end{matrix}
$$

Question 2 (medium)

Make a program that asks the user a matrix [A] and a value N that can only be 0 or 1, and "exercises" normal gravitational force if N=0, reversed gravitational force if N=1, and this on the "objects", represented by non-zero digits in the matrix.

If gravity which is submitted each caste is different, the meaning of their words is too. Thus, if a member of the upper caste says "HELLO", members of the lower caste will understand "OLLEH", which obviously has no meaning for them. Therefore, the only words that could - in theory, because the CBDH forbids them - to communicate them in an understandable way are the palindromic words that can be read and written in both directions in the same way.

Question 3 (easy)

Make a program that asks a string Str1 and displays 1 if it is a palindrome, 0 in the opposite case.

Paul and Julie would like to communicate despite the existence of this problem. They seek to develop a string converter to reverse them and make possible a conversation between the two lovers. But they are not the first ones to want to do so: in order to suppress such attempts world government ruled that the strings from Str0 to Str9 would be archived until further notice, and that UnArchive would be censored (again, until further notice). However, this is not enough to discourage them…

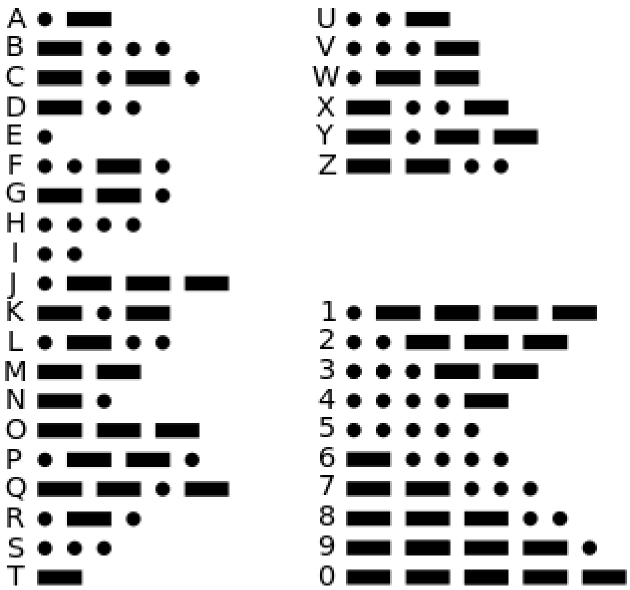
Question 4 (easy)

Make a program that asks a string Str1 and displays it after it has been reversed.

Question 5 (hard)

Make a program that retrieves the string contained in Ans (assuming Ans necessarily contains a string) and displays it after it has been reversed. This program should be legal, that is to say, it must comply with the government order stated above.

Thanks to this device, Paul and Julie were able to exchange many personal conversations … but it was bound to happen. In 2338, during a "CDRAM" operation (Control of Defects in the Random Access Memory), the two young people were trapped, and sentenced to two years in prison. But for them, this forced separation was not to break the relationship they had established. Placed in two adjacent cells separated by a wall, they decided to communicate in Morse code, which complies with the following encoding:



Question 6 (hard)

Make a program that retrieves the string contained in Ans (assuming Ans necessarily contains a string) and displays this it after it has been encoded in Morse code. This program must be legal, that is to say, it must comply with the government order stated above. The dots will be represented by the one used at the end of a sentence (getkey = 103) and dashes by the subtraction sign (getkey = 85). We will consider that only the characters in the picture above are part of the conversation, and the spaces will have to be removed from the message before its conversion.

Two years later, in 2340, Paul and Julie are released. The time they spent in total imprisonment had no effect on their love. But as they leave, they incur a new sanction: now they are obliged to put at least a 42-meters distance between them. To be heard from that distance, they would have to scream, which is prohibited by CHBD on behalf of the freedom to be quiet. They then found a new solution: The Send(command. While they are far from each other (but not too far), one of the two lovers sends a message using an emitter connected via the 2.5mm jack port. The signal, which can not pass through walls, travels the shortest possible path to the other lover, who through a receiver can listen to the message (that has been reversed, of course).

It is assumed that the Pic0 variable contains a map of the place where Paul and Julie are located. The walls are represented by straight lines 2px thick, and our two protagonists by crosses, their coordinates being (P, Q) for Paul and (J, K) for Julie. When a signal is sent, it is from the exact location of the transmitter. A signal present at the location (a, b) can be spread at the locations (a +1, b), (a-1 b), (a, b +1) or (a, b-1). The coordinates of the pixel at the bottom left is (0, 0), and we do not take account of the pixels that are unusable in TI-Basic.

<u>Question 7 (hard)</u>

Make a program that requests the variables P, Q, J, and K (which will have an integer value between 0 and 95 for P and J, between 0 and 62 for Q and K), displays the contents of pic0, places crosses (with Pt-On () where Paul and Julie are, and draws the shortest ways from the transmitter to the receiver (we suppose that Paul is speaking).

Again, Paul and Julie were quiet for a long time ... But again, it was too good to be true. Another unlawful couple, who had the same idea, was discovered after a telephone conversation in which he explained to a friend the scheme was sent to the police by an informer. Since then, "wave patrols" are made by the police to detect working transmitters and receivers. Determined not to end up in jail a second time, the two young develop an alarm which would mean they should turn off the transmitters and the receivers. Thus, when one of the two sees the patrol arrive (they can not see through walls, and the patrol arrives either the north or the west or the east or the south, and on the entire width), he or she immediately sends the alarm signal. But will they have the time? Thanks to their unfailing reactivity they are able to instantly turn off everything when they receipt the signal (or at the view of the patrol). But this signal can not pass through walls, while "patrolling wave" can do it.

__Question 8 (medium)__

Make a program that asks the coordinates of the two protagonists, and a variable N that can take only the values 1, 2, 3 or 4, which simulates the arrival of a wave patrol from north if N =1, from east is if N = 2, from south if N =3, or from west if N =4 and displays 1 if Paul and Julie have enough time to deactivate their devices, 0 if they do not. We will assume that Pic0 still contains the map of where they are, that all waves propagate at the speed of 420 ms^{-1}, and that browsing a pixel on the map corresponds to travel 5 meters in reality. If a "corridor" on the map leads to the exterior of the visible map, it is assumed that the patrol is visible only once it is in a visible location on the map.

Congratulations, you just finished! If you still have time, check that you well understood the questions, that you haven't made any mistake, and if you are sure of this, try do make better programs.