I. PLAYCARD PROBLEM

A pack of cards consists of 52 cards, which have 13 different values 1,2,3,4,5,6,7,8,9,10,J,Q,K, and four different suits: Spades, Clubs, Diamonds, Hearts (Spade and Club are black, Diamonds and Hearts are red).
We have a pack of full cards, which we shuffle. Pulling out successively 12 cards of the pack we create 3 rows of 4 cards each, which we place on the table.

If, in that phase, we pull out a J, Q or K we put that card at the end of the pack and continue pulling out cards until 3 rows of 4 cards each are completed. We now proceed checking if among the cards, we have put on the table, there are pairs of cards whose values give 10 as sum. If there are two cards with the value of 10 each, one of them is considered as having value 0.
On the above pairs of cards we place two cards of the pack ( one on each card of the pair ).
If during this phase we pull out a J, Q or K we place this on one card of the pair and this card does not take part in the procedure any more.

The procedure continues until the 12 faces of the cards are covered by J,Q,K or there are no more pairs of cards with sum 10.
Write a program which simulates the above procedure with the following demands:

1. - The number N of repetitions of the above procedure must be entered from the keyboard. When N equals 1, each of 2,3 and 4 below takes place.

2. - (a) The pack of cards must be created and, for each repetition the pack of cards must be shuffled by the program.

(b) The pack of cards must be displayed on the screen.

3. - (a) The 12 cards must be placed on the screen according to the procedure described above.

(b) The remaining cards in the pack must be displayed on the screen.

4. - (a) The cards that are covered according to the above procedure must be replaced with the cards that replace them and this must be shown on the display.

(b) After each replacement, the remaining cards of the pack must be displayed on the screen.

5. - After 5 repetitions, a histogram must be presented which will display the number of cards which remain in the pack after the end of each procedure.

Evaluation:

| | |
|---|---|
| 1 | 10 points |
| 2(a) | 15 points |
| (b) | 5 points |
| 3(a) | 10 points |
| (b) | 5 points |
| 4(a) | 10 points |
| (b) | 5 points |
| 5 | 15 points |
| Code | 10 points |
| Jury | 15 points |

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II. TREES PROBLEM

A farmer wants to preserve a rare class of ancient cypress trees. In order to do that he has taken note of the position of each tree and he has decided to surround the trees with wire drawing a polygon such that they lie entirely inside it. In order to reduce his costs, he needs to minimize the length of wire. The farmer wants to build a rectangular house, one of its sides being parallel to the X-axis, and he needs to know the relative location of the house:

(1) The house is outside the polygon.
(2) The house is inside the polygon.
(3) The wire divides the house in two regions whose areas are different from zero.

Write a program capable of accomplishing the following tasks:

(A) Finds the trees that will be the vertices of the polygon.
(B) Calculates the length of wire that will be used.
(C) Indicates in which of the above mentioned locations (1,2,3) the farmer's house is.

Input:
- N: The number of the trees.
- (Xi,Yi) 1<=i<=N, N<=20, Xi,Yi>0; The coordinates of the points corresponding to each tree.
- (a,b), (c,d), a,b,c,d>0; The beginning and ending points of the house's main diagonal.

Output:
- A sequence of M points (1<=M<=N) with the property that if we trace through the points in the order in which they appear, we trace the outline of the polygon.
- The length of wire that will be used.
- The indication of the position of the house in the form "1","2", or "3".

Evaluation:

| | |
|---|---|
| Input | 10 points |
| A | 40 points |
| B | 10 points |
| C | 30 points |
| | 10 points reserved for the Jury |

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III. ***SQUARE PROBLEM (Selected for the 1st round)

Enumerate the position of a 5x5 matrix, in the following way: If the number i (1<=i<=25) has been assigned to a matrix position with coordinates (x,y), then the number i+1 can be assigned to the matrix position with coordinates (z,w) according to one of the following rules:

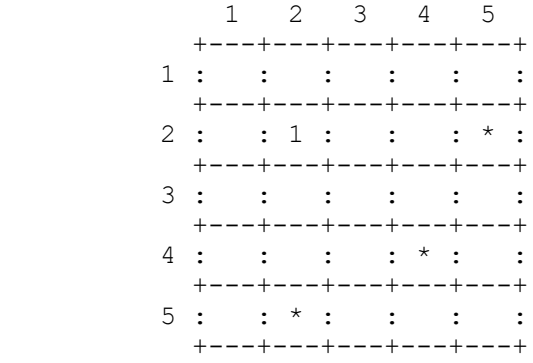
(1) (z,w) = (x+-3,y)
(2) (z,w) = (x,y+-3)
(3) (z,w) = (x+-2,y+-2)

The problem is:

(A) Write a program that enumerates the positions of the 5x5 matrix for a given starting position with the number 1.

(B) Compute the number of all possible enumerations for every starting position at the upper right part of the matrix, including the maindiagonal.

Example:
If the matrix position with coordinates (2,2) is selected as the starting position, then the next matrix position to which number 2 will be assigned, can be one of the following positions with coordinates: (2,5) or (5,2) or (4,4). These positions are marked in figure 1 by an asterisk (*).




Note:
It will be appreciated if the output looks like the one in Figure 1.

Evaluation:

| | |
|---|---|
| (A) | 50 points |
| (B) | 25 points |
| Output | 15 points |
| | 10 points reserved for the Jury. |

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IV. LANGUAGES PROBLEM

You are given an ASCII text file which contains some natural language text (eg. English, French, German, etc.) where the language used is unknown, but the characteristic of the language is the Latin style (Latin alphabet).
The problem is:
Analyze the contents of this file to determine the language used.
(A) Write a program which will read the contents of the file and count the number of characters in it. Print the total.
(B) Modify the program in (A) to also count the number of occurrences of each letter of the alphabet, converting delimiters and punctuation to the space (' ') character, and lowercase characters to uppercase ones, i.e. the only characters considered in the count will be elements of the set [' ','A'..'Z'].
Sort the characters in this set in order of frequency, i.e. the most frequently occurring characters appearing at the start of the list. Print the sorted list out.
(C) Modify the program written in (B) to count the frequency of characters. Normalise the counts, i.e. divide the frequency of each character by the total number of characters read; this will give you a relative frequency which is independent of the number of the characters in the text. Write the relative frequency counts to a data file.
(D) Extend the program written in (C) so that it may accept to read a text data file and compare it with given text files of known languages. The comparison method will be of your own invention. The result should be a report of the language which the program thinks the original text is written in.

Note:
The given text files of the known languages are under the names ITA, FRA, etc. for Italian, French, etc. respectively. The text data file has the name TEXT.
Evaluation:

| | |
|---|---|
| (A) | 10 points |
| (B) | 20 points |
| (C) | 20 points |
| (D) | 40 points |
| | 10 points reserved for the Jury. |

Sample text:

Morire in consequenza di anabolizzanti intrapresa per migliorare le proprie prestazioni atletihce 'e poi molto diverso dal morire al volante di un'auto di formula uno mentre si tentra di battere un record affrontando i rischi legati a quelle prove, o dal perire vittime di una scarica di sassi mentre si tenta una prima salita su una parete Nord di qualche colosso alpino? Che ci sia o no di mezzo la farmacologia, l'artificiale,il chimico, conta

relativamente poco,sul piano essenziale, anche se sembra molto rilevante dal punto di vista dell'immaginario cillettivo; il quale ancora considera spesso un eroe il pilota di auto da corsa o il grande alpinista, e ha invece un atteggiamento molto diverso nel caso di chi perisca vittima di un doping incauto. Naturalmente , qui entrano in gioco altri elementi,solo indirettamente morali. Fare uso di stimolanti chimici 'e in genere vietato nello sport, chi viola questa norma commette una grace slealta: ma qui l' esecrazione morale non 'e motivata anzitutto dal fatto che viene messa a repentaglio l'integrita fisica dell'atleta, bensi dal mancato rispetto per regole del gioco. Le quali, per altro,vietano il doping anche e soprattutto per il danno fisico che esso alla lunga provoca; ma in base allo stesso principio, forse, dovrebbero vietare anche pratiche sportive "leali" e tuttavia non memo pericolose per chi le pratica..