ICPSC

INTERNATIONAL COMPETITION IN PROGRAMMING

Elementary Division Problems

YEARS OF
1982-1983-1984-1985-1986-1987-1988-1989
1990-1991-1992-1994
(60 Questions)

1. LETTER HOME

You are away at summer camp and you have run out of money. You plan to write a letter home to ask for more. Everyone else a camp is in the same situation. Since you are learning how to program a computer, you decide to write a program that will generate a letter that anyone in your situation can use.The contents of the letter is up to you but it must include certain pieces of information that are supplied by the user of the program. The information is underlined in the following sample letter which you may use.

DEAR MOM AND DAD,
THE $15.00 YOU GAVE ME FOR SPENDING MONEY AT CAMP IS GONE. I SPENT MOST OF IT ON SNACKS. DO YOU THINK YOU COULD SEND AN EXTRA $5.00?   THINKING OF YOU OFTEN.

                              LOVE, KAREN

Write a program that asks for all the underlined information and prints out a letter home. It is not important that your letter look exactly like this one, but it must contain the same information.

2. SECOND THOUGHTS

Write a program that will compute how long a person sleeps at night in seconds. Assume that the person goes to bed between noon and midnight and gets up between midnight and noon. The computer should ask you to enter the time when you go to bed and the time when you wake up: hours, minutes, and seconds.

Run your program with a bed time of 10,45,32 (h,m,s) and a wake up time of 7,34,47 (h,m,s). Run it again with a bed time of 2,00,00 and a wake up time of 12,01,01.

Sample Run

WHAT TIME DID YOU GO TO BED   (HOURS, MIN,SEC)
10, 45, 32

WHAT TIME DID YOU GET UP?   (HOURS, MIN,SEC)
7,34,47

YOU SLEPT FOR 31755 SECONDS.

3. STAR TRACKS

Write a program that will produce the following design.

```
    *
   * *
  * * *
 * * * *
* * * * *
```

Write the program using only one *.

Making A$ ="*" and using A$ more than once is also not allowed.

4. EGG TOSS

You and your partner decide to enter an egg toss contest. You toss an egg back and forth trying to keep it from breaking. On each toss, the chances that the egg breaks is .2 (20% or 2 out of 10). If you make 6 good tosses before the egg breaks, then you win.

Write a program that simulates the egg toss contest. Run the program until you get a win. Print out wins and losses as follows:

Sample Run
GOOD   GOOD   GOOD   SPLAT!

Sample Run
GOOD   GOOD   GOOD   GOOD   GOOD   GOOD   YOU WIN!

5. WORTH OF WORDS

The value of a letter in the alphabet (A . . Z) is defined as the position of that letter in the alphabet. Thus A = 1, B = 2, C = 3 and so on with Z = 26. The worth of a word is defined as the sum of the value of each letter in that word. For example, the worth of the word CAB is 6.

Write a program that will accept a word as input and compute its worth.

Test your program with the words PRICELESS and WORTHLESS.

Sample Run

ENTER A WORD: PRICELESS

THE WORTH OF THE WORD
PRICELESS IS 106.

6. ALPHABETICALLY   SPEAKING

Write a program that accepts a sequence of three letters and checks whether they are in alphabetical order.
Test your program with the letters:B,A, D and E, F, H

Sample Run
ENTER THREE LETTERS: B,A,D

B A D ARE NOT ALPHABETICAL

7. LUNCH AT MAC DUFFY'S

Write a program that asks the user to place an order for lunch at Mac Duffy's and prints out the bill similar to the one shown in the sample run.
Test your program by entering 3 hamburgers, no fries and 2 soft drinks.

Run the progam again with the numbers
(7,2,4).

Sample Run

```
    LUNCH ORDER
ORDER OF HAMBURGERS: 3
ORDER OF FRENCH FRIES:0
ORDER OF SOFT DRINKS: 2

    LUNCH BILL
ITEM            COST    NUMBER
HAMBURGERS      $1.15    3
FRENCH FRIES    $ .55 .   0
SOFT DRINK      $45 ...   2

PLEASE PAY $4.35   THANK YOU !!
```

8. DEBUGGED

The first time you write a program it usually has a bug in it When you try to correct the problem and run it again, it may still have a bug.

Assume that 7 out of 10 times a program is run it has a bug in it.

This is true on the first run, the second run, and as many runs as necessary until the program run "bug free."

Write a program that simulates the debugging of a program which satisfies this condition. Print BUG if a bug is found or DEBUGGED if not.

Run the program five times and compute the average number of bugs in all five runs. (The average is the total number of bugs in all five programs divided by 5.)

Sample Run

```
1 BUG  BUG  DEBUGGED !!
2 BUG  BUG  BUG  DEBUGGED !!
3 DEBUGGED !!
4 BUG  BUG  BUG  DEBUGGED !!
5 BUG  BUG  DEBUGGED !!

AVERAGE NUMBER OF BUGS = 2.
```

9. FACTORIAL CHART

A Factorial Chart from 1 to 5 looks like the following:

FACTORIAL CHART FROM 1 TO 5

1! = 1
2! = 1x2
3! = 1x2x3
4! = 1x2x3x4
5! = 1x2x3x4x5

Write a program that will generate a FACTORIAL CHART FROM 1 TO N for any whole number N between 1 and 9. Do not compute the factionals.

Test your program with N = 5 and N = 9.

Sample Run

ENTER A VALUE FOR N: 6

FACTORIAL CHART FROM 1 TO 6
1! = 1
2! = 1x2
3! = 1x2x3
4! = 1x2x3x4
5! = 1x2x3x4x5
6! = 1x2x3x4x5x6

10. SIMPLE LATIN SQUARES

The square arrangement of whole numbers

1 2 3 4
2 3 4 1
3 4 1 2
4 1 2 3

is called a 4 x 4 LATIN SQUARE because each whole numbers 1, 2, 3, and 4 appear once and only once in each row and column. There are many ways to arrange the numbers and still make a LATIN SQUARE.
Of all the 4 x 4 LATIN SQUARES, the one above has a simple pattern We call it a SIMPLE 4X4 LATIN SQUARE.

Write a program that will generate a similar SIMPLE N x N LATIN SQUARE for any whole number N between 2 and 9.

Test your program with N = 4 and N = 9.

Sample Run

ENTER A WHOLE NUMBER BEWTEEN 2 AND 9: 6

SIMPLE 6X6 LATIN SQUARE

1 2 3 4 5 6
2 3 4 5 6 1
3 4 5 6 1 2
4 5 6 1 2 3
5 6 1 2 3 4
6 1 2 3 4 5

11. WORD TRIANGLES

```
  D
 A A
D A D
```

is a Word Triangle.

Any word that begins and ends with the same letter can be made into a Word Triangle. Write a program that will print out Word Triangles for words of up to 5 letters long. Your progam should ask the user to enter each row of the Word Triangle and then output the completed design.

Test your program with the words
MOM, and TREAT.

Sample Run

```
ENTER ROW 1:     T
ENTER ROW 2:     O O
ENTER ROW 3:     O   O
ENTER ROW 4:    T O O T
ENTER ROW 5:
```

```
   T
  O O
  O   O
 T O O T
```

12. SPORT OF KINGS

Man o' War and Swaps, two great horses from racing history, are back again to race each other. But this time it is to be done on the computer.
Write a program that will simulate the greatest horse race of all time. Here are the rules.
1.The track is 1000 yards in length. The winner is the first horse to travel 1000 yards or more.
2.Man o' War advances X yards while Swaps advances Y yards according to the rules:
X = 9 * Y + 11 - 64 * (INT ((9 * Y + 11)/64))
Y = 9 * X + 12 - 64 * (INT ((9 * X + 12)/ 64))
3.To begin the race, a seed number of 11 is chosen for Y. This number is used to compute Man o' War's first advancement X. The resulting X value is used to compute Swap's first advancement Y. The resulting Y value is used to compute Man o' War's second advancement X. The resulting X value is used to compute Swap's second advancement Y. The moves continue in this way until the race is over.
4.Stage 1 is the total distance traveled by a horse after the 1st advancement. Stage 2 is the total distance traveled by a horse after the 2nd advancement. And so on until the race is won.

Sample Run

SPORT OF KINGS

Stage	Man o' War	Swaps
1	46	41
2	106	80
3	148	85
_		_
_		_

And the winner is ????

13. CRUNCH

MSSSSPP is the crunched version of the word MISSISSIPPI with all the I's taken out. A phrase can be crunched too!

AILOAD COSSING is the crunched version of RAILROAD CROSSING with the letter R taken out.

Write a program that will CRUNCH out any letter supplied by the user from any phrase (up to 60 characters long).

1. The program should ask the user to enter a phrase and any letter to be crunched out.

Test your program with the phrases:

RAILROAD CROSSING WITHOUT ANY R
(Remove the letter R)

CRUNCH A BUNCH OF MUNCHIES FOR LUNCH
(Remove the letter U)

Sample Run

ENTER A PHRASE:
RAILROAD CROSSING WITHOUT ANY R

ENTER A LETTER: R

AILOAD COSSING WITHOUT ANY

14. WORLD SERIES

In the World Series of Baseball two teams play each other until one team wins four games. The first team to win four games is the winner, and the series ends. There must be at least four games played in a world series and it can last for up to seven.

Write a program that will show all the ways the first four games of the World Series can be won or lost by a baseball team. A game loss is indicated with an L, a win is noted with a W. The outcome of the series is a WIN or a LOSS.

Write a program that will generate a listing similar to the one shown in the sample run. Your program does not have to list the outcomes in the same order, but it must list them all.

Sample Run

FIRST FOUR GAME OF THE WORLD SERIES

GAME					
1	2	3	4	WINS	LOSSES
L	L	L	L	0	4
L	L	L	W	1	3
L	L	W	L	1	3
L	L	W	W	2	2
L	W	L	L	1	3
L	W	L	W	2	2
L	W	W	L	2	2
L	W	W	W	3	1
….					
….					
W	W	W	W	4	0

15. WELL ORDERED NUMBERS

The number 138 is called WELL-ORDERED because the digits in the number (1,3,8) increase from left to right (1 < 3 < 8). The number 365 is not well-ordered because 6 is larger than 5.

Write a program that will find and display all possible three digit WELL-ORDERED numbers. Report the total number of three digit WELL-ORDERED numbers.

Sample Run

THE THREE DIGIT WELL ORDERED NUMBERS ARE:
123 124 125 126 127 128 129 134
135 136 137 138 139 145 146 147
148 149 156 157 158 159 167 168

... ...
... ...
... ...
678 679 689 789

THE TOTAL NUMBER IS ??

16. SQUARE DESIGN
Write a program that will generate the following Square Design. Do it with as few PRINT statements as possible.
```
+-----------+
I-X-X-X-X-X-I
I-X-X-X-X-X-I
I-X-X-X-X-X-I
I-X-X-X-X-X-I
I-X-X-X-X-X-I
+-----------+
```

17. ORDERED NUMBERS

A 4-digit number WXYZ is called an Ordered Number if the difference between the first two digits, WX, and the last two digits, YZ, is equal to 1 (WX-YZ=1 or YZ-WX =1). For example, 1213 and 4645 are Ordered Numbers, while 2345 and 7685 are not Ordered Numbers.

Write a program that will only accept a 4-digit number and will determine if it is an Ordered Number. Test your program with the numbers: 1213, 2345, 999, and 4645.

Sample Run
ENTER A 4-DIGIT NUMBER: 1213

1213 IS AN ORDERED NUMBER.

18. 4X4 CHECKER CHALLENGE

Look at the 4x4 checkerboard below and try to place four checkers on the board so that one and only one is placed in each row, each column, and each main diagonal:

Write a program that will compute the number of different ways of solving the 4x4 Checker Challenge. Express your results as shown in the sample run .

Sample Run

THERE ARE ? SOLUTIONS TO THE 4X4 CHECKER CHALLENGE.

19. WINNING COMBINATIONS

Three runners, A, B, and C, enter as a team in a 10 mile relay race. Two of the runners will run 3 miles each, and the best runner will run 4 miles. All runners have a normal time that they run for their first, second, third, and fourth mile. It is given by the following rule:

Time in seconds for Nth mile

Runner A
256+9xN+13 16xINT((9xN+13)/16)

Runner B
256 +13xN +15 -16xINT(13xN+15)/16)

Runner C
256 + 7xN +9 -16xINT((7xN+9)/16)
(INT stands for Integer part.)

Write a program that will determine which runner should run the 4 mile leg in order for the team to have the best time. This is the Winning Combination. Also print the best time for the team.

Sample Run

RUNNER ? RUNS 4 MILES.

THE BEST TIME IS ???? SECONDS.

20. JUSTIFYING TEXT

Write a program that will accept a sentence of text from the keyboard in any convenient way and print the sentence in a column 20 characters wide. Words at the end of a line that would lengthen the line beyond 20 characters must be moved to the next line. This is called Justifying Text. Test your program by entering the sentence:
A great discovery solves a great problem but there is a grain of discovery in the solution of any problem.

Sample Run

A great discovery
solves a great
problem but there is
a grain of discovery
in the solution of
any problem.
Note: Your solution need not be right justified.

21. GRAPH

Write a program that will generate and print the graph below. The fewer print statements you use, the higher your solution will be rated.

```
!       *
!     *
!    *
!  *
! *
* - - - - -
```

22. PRIME CRYPTARITHM

The following multiplications problem can be solved by substituting only prime digits (2, 3, 5, or 7) into the positions marked *. This is called a Prime Cryptarithm.

```
  * * *
x     *
 -------
* * * *
```

Write a program that will find all solutions to this Prime Cryptarithm.

Sample Run

```
3 2 5
x   7
-------
2 2 7 5


5 5 5
x   5
-------
2 7 7 5

..........
..........
```

23. STEPPING STONES

A set of stepping stones with lengths 1, 1/2, 1/3, 1/4, 1/5 ... (continuing on with this pattern) are available -- one step for each size. It takes at least four steps placed in a stair-step fashion with decreasing step-size (as shown below) for the total height to exceed 2. Three steps are not enough; four is the minimum number of steps necessary to equal or exceed the height of 2.

Write a program that asks the user for a height H between 1 and 8, and then computes the minimum number of steps necessary to equal or exceed this height. Test your program for H = 5 and 7.

Sample Run

ENTER HEIGHT BETWEEN 1 AND 8 ? 5
83 STEPS NEEDED TO EQUAL OR EXCEED 5 .

24.TOWER BUILDING

With the   *   symbol and the PRINT command any tower can be built.

Write a program to generate the following tower with THREE or less print commands?

```
   *
  ***
 *****
*******
```

25. DART BOARD

Darts thrown at a dart board land in different regions of the board numbered as shown below.

Write a program that simulates the random tossing of 500 darts at the above board. Assume that each region is equally likely to be hit by a dart.

Print out a report as shown in the sample run below. The % column indicates the percent of the 500 darts that land in the region.

Sample Run

REGION	HITS	%
1	37	7.4
2	52	10.4
3	40	8
4	46	9.2
5	55	11
6	61	12.2
7	52	10.4
8	57	11.4
9	50	10
10	50	10

26. SENTENCE SPLITTER

Write a program that asks the user to enter a sentence and then splits out the words in the sentence and puts them in a table. Test your program with the sentence:

NOW IS THE TIME FOR ALL GOOD PROBLEM SOLVERS TO SOLVE THIS PROBLEM.

You may assume that sentences are no longer than 70 characters long.

Sample Run

ENTER A SENTENCE:
NOW IS THE TIME FOR ALL GOOD PROBLEM SOLVERS TO SOLVE THIS PROBLEM.

THE WORDS IN YOUR SENTENCE ARE:
NOW
IS
THE
TIME
FOR
ALL
GOOD
PROBLEM
SOLVERS
TO
SOLVE
THIS
PROBLEM

27. SAFE CRACKING

To open a safe requires knowing three single digits (1-9). For example, the three digits 5 - 4 - 9 is a valid combination. A secret message has been found that gives clues about the combination to the safe.

1. The digit 1 is not used.
2. All of the digits are different.
3. The first digit plus 3 times the second digit plus 5 times the third digit is the same number as the product of all three digits.

Using these clues write a program to crack the safe.

Sample Run

THE COMBINATION IS ? - ? - ?

28. REVERSE

Write a program that asks the user for a list of words and prints the list in reverse order.

Test your program with the list:
WHAT YOU SEE IS WHAT YOU GET

Sample Run

ENTER A LIST OF WORDS:
THIS IS IT

IT IS THIS

29. BIRTHDAY OF THE WEEK

"On what day of the week were you born?" I asked this question of a group of 14 people and received six different answers. I expected to get seven different answers -- one for each day of the week (MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, SATURDAY, AND SUNDAY).

Call the day of the week you were born your BIRTHDAY OF THE WEEK.

Assume that every day of the week is equally likely to be a birthday of the week. What would the results be if you asked a group of 14 people to tell you their birthday of the week?

Write a program to simulate picking at random 14 birthdays of the week from the 7 possible days of the week.

Sample Run

RANDOM SAMPLE OF 14 BIRTHDAYS OF THE WEEK:

WED MON SAT TUE FRI TUE SUN MON MON
WED TUE SUN SAT WED

30. WORD SEARCH

If you look carefully at the line of letters below you will recognize certain hidden words. Your job is to program the computer to find the words for you.

Write a program to find the words: THE, BEST, CONTEST hidden in the line of letters:

SWFTHEGDCBESTFCONTESTYGFDSWER

Print out each word and the position in the line where it begins.

Sample Run

THE - BEGINS AT POSITION 4
BEST - BEGINS AT POSITION ?
CONTEST - BEGINS AT POSITION ?

31.DIAMOND

Write a program than will print the following diamond. Use as few PRINT statements as possible.

```
     $
    $-$
   $-$-$
  $-$-$-$
 $-$-$-$-$
  $-$-$-$
   $-$-$
    $-$
     $
```
Note: Your experiment will most likely show different results.

32. NUMBER TRIANGLES

The numbers in the triangles below reveal a pattern for a NUMBER TRIANGLE.

```
1
2 6
3 7 10
4 8 11 13
5 9 12 14 15
```

Discover this pattern and write a program to generate NUMBER TRIANGLES for any size (number of rows) N between 1 and 9.

Test your program for N equal to 5 and 9.

Sample Run

ENTER A SIZE N BETWEEN 1 AND 9: 3

```
1
2 4
3 5 6
```

Sample Run

ENTER A SIZE N BETWEEN 1 AND 9: 5

```
1
2 6
3 7 10
4 8 11 13
5 9 12 14 15
```

33. PATTERNS

Examine the pattern of numbers in the triangle of size 8 shown below.

```
1
1 1
1 1 2
1 1 2 3
1 1 2 3 5
1 1 2 3 5 8
1 1 2 3 5 8 13
1 1 2 3 5 8 13 21
```

From the pattern, figure out what the next row should be. Write a program that will generate this triangle for any number of rows from 1 to 10. Test your program for N=8 and N=10.

Sample Run

ENTER A VALUE FOR N: 6

```
1
1 1
1 1 2
1 1 2 3
1 1 2 3 5
1 1 2 3 5 8
```

34. DIE TOSS

A die is a cube with six equal sides {1, 2, 3, 4, 5, 6}. The function INT(6*RND(1) +1) (or similar function) picks a number from 1 to 6 that can be used to simulate the tossing of a die.

Write a program that uses this function to simulate the tossing of a die. Have the user enter the number of times, N, the die is tossed and print a list showing how many times each value from 1 to 6 appears.

Test you program for the number of trials N = 100 and 200.

Sample Run

Enter the number of trials: 100

value	count
1	14
2	13
3	18
4	19
5	20
6	16
total	100

35. FOUR SUMS

Write a program that will find and count the number of ways that any whole number between 3 and 15 can be written as the sum of four positive whole numbers.

Test your program for N= 10.

Sample Run

Enter a number BETWEEN 3 AND 15: 8

THE four SUMS ARE:
8 = 1 + 1 + 1 + 5
8 = 1 + 1 + 2 + 4
8 = 1 + 1 + 3 + 3
8 = 1 + 2 + 2 + 3
8 = 2 + 2 + 2 + 2

total number FOUR SUMS = 5

Note: Rearrangement of the same numbers are not counted as different sums.
The sum
8 = 5 + 1 + 1 +1
is not considered different from
8 = 1 + 1 + 1 + 5.

36. ARROW

Write a program that will create the following arrow using PRINT "*"; statements. Use no more than three such statements in your program.

```
    *
    **
    ***
    ****
*********
    ****
    ***
    **
    *
```

37.TRIANGLES

Write a program that will print a triangle, similar to one below, with each side containing N symbols. This is a triangle of size N.

Test your program for size N=7 and N=10.

Sample Run

WHAT IS THE SIZE? 7

```
*
**
* *
*  *
*   *
*    *
*******
```

38. EVEN UP

If you toss the same coin four times should you expect get two heads and two tails?

To investigate this problem, write a program that will simulate the tossing of a fair coin four times and count the number of heads and tails. Repeat the experiment ten times and report the results as follows:

Sample Run

	H	T
HTTT	1	3
THHH	3	1
HTTT	1	3
THTT	1	3
TTTT	0	4
TTHH	2	2
HTTH	2	2
HTTT	1	3
TTHH	2	2
HHHH	4	0

Heads =Tails 3 out of 10 times.

39. SECRET CODE

You have just found the secret instructions on how to code a message.

"Translate each letter in the message by substituting the letter 3 characters to the right in the alphabet. Letters at the end of the alphabet (XYZ), wrap around to the beginning (ABC). Blank spaces are left alone."

Top letters translate to the bottom letters.
ABCDEFGHIJKLMNOPQRSTUVWXYZ
DEFGHIJKLMNOPQRSTUVWXYZABC

For example, with this skip 3 substitution code the message :
ALL IS WELL
is transformed into the message:
DOO LV ZHOO

A secret message has just come over the wire which reads:
CSY.LEZI.GVEGOIH.XLI.WIGVIX. GSHI
(a period indicates a space)

Your mission, if you dare to accept it, is to write a program that will decode this message and similar coded messages. The same substitution code was used to code this message but with a slightly different value for the number of characters skipped to the right. Try different skip values until the code is cracked.

40. SUM TO N

Consider any three digits such as   9   5   2   which decrease from left to right. The three digits represented by

I   J   K

are values from 1 to 9 with I larger than J and J larger than K
(I > J > K).

Insert either a plus (+) or a minus (-) in the space between the digits and SUM the numbers.

For Example   9 - 5 + 2 = 6

Write a program that will find all triples that satisfy the above conditions and which SUM TO N.

Test your program for N=6 and N=13.

Sample Run

INPUT "ENTER A VALUE FOR N";6
THE SUMS TO 6 ARE:
9 - 2 - 1 = 6
9 - 4 + 1 = 6
9 - 5 + 2 = 6
9 - 6 + 3 = 6
9 - 7 + 4 = 6
9 - 8 + 5 = 6
8 - 3 + 1 = 6
8 - 4 + 2 = 6
8 - 5 + 3 = 6
8 - 6 + 4 = 6

8 - 7 + 5 = 6
7 - 2 + 1 = 6
7 - 3 + 2 = 6
7 - 4 + 3 = 6
7 - 5 + 4 = 6
7 - 6 + 5 = 6
5 + 4 - 3 = 6
5 + 3 - 2 = 6
5 + 2 - 1 = 6
4 + 3 - 1 = 6
3 + 2 +1 = 6

41. DICTIONARY ORDER

If you translate the numbers from 1 to 9 into words, the number 1 becomes "one", 2 becomes "two", 3 becomes "three", and so on down to 9 which becomes "nine". As words "eight" comes before "one" in the dictionary.

Write a program that accepts three digits from 1 to 9 and prints their corresponding words in Dictionary Order.

Test your program with 3,4,5 and 2,8,2

Sample Run

Enter three digits from 1 to 9
? 3,4,5

DICTIONARY ORDER
Five, Four, Three

42. WINNING STREAK

When you flip a coin you win every time it comes up heads and lose if it comes up tails. Assume you win on the first toss and continue flipping until you suffer a loss (tail). The WINNING STREAK is the number of wins until the first loss.

For example HHHT is a WINNING STREAK OF 3.

Write a program that will simulate the experiment that begins with a head (win) and continues flipping a coin until the first loss (tail) and report the length of the WINNING STREAK. Repeat the experiment 10 times.

Sample Run

TRIAL	WINNING STEAK
1 HT	1
2 HHT	2
3 HHHHHT	5
4 HT	1
5 HHT	2
6 HHHHHHHHHT	9
7 HT	1
8 HHT	2
9 HT	1
10 HHHHT	4

43. MAKING CHANGE

When you buy something for less than one dollar and pay with a dollar bill you get change back. Usually the change is given back in the fewest number of coins. Write a program that will make change for any purchase of less than 1 dollar. Express the change in the fewest number of coins possible.

The coins you have to work with are: half-dollar, quarter, dime, nickel, and penny.

100 cents =	1 dollar
50 cents =	1 half-dollar
25 cents =	1 quarter
10 cents =	1 dime
5 cents =	1 nickel
1 cent =	1 penny

Test your program with purchases of 23 cents and 51 cents.

Sample Run

What is your purchase in cents? 23

Your change is
 1 half-dollar
 1 quarter(s)
 2 penny(ies)
 Thank you.

44. FRIDAYS IN 1990

What are the dates of all Fridays in 1990? Write a program that will find the dates of all Fridays in 1990. Print the dates in the form shown in the sample run.

You need to know the following.

1. The first Friday in 1990 occured on the 5th of January.
2. Thirty days has September, April, June, and November, all the rest have 31 except for February which has 28 except in leap years when it has 29.
3. 1990 is not a leap year.

Note: To make it fair for everyone, you may not use any built-in date functions from your computer language.

Sample Run

The Fridays in 1990 occur on:
1/5, 1/12, 1/19, 1/26
2/2, 2/9, 2/16, 2/23
3/2, 3/9, 3/16, 3/23, 3/30
4/6, 4/13, 4/20, 4/27
5/4, 5/11, 5/18, 5/25
....
12/7, 12/14, 12/21, 12/28

45. WORD CHAIN

A Word Chain is a sequence of words which differ by one letter. The following sequence is a word chain

MOM MOP MAP TAP TOP TOW

because each adjacent word differs by exactly one letter.

Write a program that accepts a sequence of words and tests whether it is word chain.

Test your program with the sequence HEAL, HEAD, DEAD, DEED, DEER, BEER and the sequence TWO, TOO, TOP, PIP, POP. After each sequence print whether it is or is not a word chain.

[You may enter your words in the program in DATA statements]

Sample Run

MOM MOP MAP TAP TOP TOW
is a word chain.

TWO TOO TOP PIP POP
is not a word chain.

46. LETTER E

Write a program that will create the letter E of any odd size N < 20.
Test your program for N = 7, 9

Sample Run
Enter an odd number: 5

```
*****
**
****
**
*****
```

Enter an odd number: 7

```
*******
**
**
******
**
**
*******
```

47. BIRTHMONTH

If you asked people at random for their birthmonth (the month in which they were born), how many people would you expect to ask until someone shared your birthmonth?

For example, if you were born in JAN and you started asking people at random for their birthmonth, you might get the following response:

MAR   JUN   APR   DEC   FEB   NOV   JAN

In this experiment it took 7 tries until someone shared your birthmonth.

Set up a random experiment that counts how many people were asked until someone shared your birthmonth.   Repeat this experiment 100 times and report the average count for all 100 experiments.

You may assume that each month is equally likely to be a birthmonth: 1/12.

Enter your birthmonth as a number:
1 - JAN, 2 - FEB... 12 - DEC.

Sample Run

What is your birthmonth? 2

After 100 experiments, the average number of people asked until someone shared your same birthmonth was 11.81

48. PAIRS

Write a program that lists all pairs (two people) that can be selected from a group of size N. (Assume N<=26.)

Use a letter of the alphabet to identify each person. Print two letters to represent each pair and compute the total number of pairs that can be formed from a group of size N.

Note that AB is the same pair as BA.

Test your program for group size N = 7 and N = 11.

Sample Run

Group size = 7

PAIRS FROM A GROUP OF SIZE 7

AB AC AD AE AF AG
BC BD BE BF BG
CD CE CF CG
DE DF DG
EF EG
FG

TOTAL NUMBER OF PAIRS IN A GROUP OF SIZE 7 IS EQUAL TO 21

49. PALINDROMES

The number 1991 is a palindrome because it is the same number when read forward or backward. Write a program that finds and prints all palindromes between two numbers a and b. You may

assume that a and b are between 0 and 9,999.

Test your program with a,b = 1000, 2000 and a,b = 2000, 4000

Sample Run

a,b = 1000,2000

Palindromes between 1000 and 2000

1001   1111   1221   1331   1441
1551   1661   1771   1881   1991

50. STOP SIGN

Write a program that will generate and print out the stop sign shown below. The program must use at most five PRINT commands.

```
   * * * *
  *       *
 *         *
*           *
*           *
*           *
*           *
 *         *
  *       *
   * * * *
```

51. SAILORS AND A MONKEY

Five sailors and a monkey are on an island. One evening the sailors round up 15,621 coconuts on the island and put them in one large bin. They decide to wait until morning to divide up the coconuts, so they go to bed. During the night, the first sailor gets up, separates the coconuts into 5 equal piles with one left over, which he gives to the monkey. He decides to hide one of the piles for himself and he puts the remaining 4 piles back in the bin. He then returns to his hammock, content that at least he got his share.

But he is not alone. During the night, each sailor gets up and does exactly the same thing: gives one coconut to the monkey and takes 1/5th of the total coconuts left for himself.

In the morning the 5 sailors come together again and divide the remaining coconuts in the bin into 5 equal piles with one coconut left over for the monkey. How many coconuts does each sailor and the monkey get?

Write a program that computes how many coconuts each sailor and the monkey got.
(Your program should be general enough so it could work with a different number of sailors and an appropriate number of coconuts.)

Sample Run

Sailor	Coconuts
1	4147
2	3522
3	3022
4	????
5	????
Monkey	6

======================
| Total | 15621 |

52. BAR CHART

Write a program that asks the user to enter three numbers A,B,C where 0<=A<=B<=C<=20 and then prints out a bar chart as shown in the sample run.
Test you program with the numbers 3,6,9 and 3,9,12.

Sample Run

Please enter A,B,C with 0<=A<=B<=C<=20: 1,3,5
```
 3  6  9
 *  X  @
    X  @
    X  @
       @
       @
```

53. UNIQUE QUOTIENTS

Find all unique solutions to the quotient:
        ABC / DE = 9
where the digits A, B, C and D,E are all odd digits taken from the set 1,3,5,7,9 . The efficiency of your algorithm will be used to award design and speed points.

Sample Run
117 / 13 = 9
135 / 15 = 9
153 / 17 = 9
171 / 19 = 9
315 / 35 = 9
... / .. = 9

54. LIST TO NINE

Start with a two digit number AB with A_B, say 19. Reverse the digits to get 91 and take the difference between 91 and 19 to get the next number in the list 72 = 91-19. Repeat this process with 72 to get the next number 45 = 72-27. One more repetition of the same process yields 9 = 54-45. The LIST TO NINE is:

        19 72 45 9

The length of the list is 4.

Write a program that asks the user to enter a two digit number AB and then generates, using the process described above, its LIST TO NINE. If A=B it stops at zero. Display the list and it's length.

Test your program with the numbers 19, 55 and 29.

Sample Run

Please enter a number AB between 10 and 99 with A<>B: 19

        19   72   45   9
    **** LIST LENGTH = 4

55. LET'S MAKE A DEAL

A prize is placed behind one of three doors. You are invited to find it by picking any one of the doors. Write a program that simulates making 100 choices and computing the number of wins and losses. A win occurs if you pick the door with the prize behind it.

Repeat this simulations 10 times and report the results as shown in the sample run.

Sample Run

PICK ONE OF THREE DOORS TO FIND THE PRIZE
10 SIMULATIONS OF 100 TRIALS EACH

WINS	LOSSES
34	66
38	62
31	69
31	69
36	64
34	66
31	69
34	66
37	63
28	72

56. PAGE LAYOUT

You are a document layout specialist and you are given text to input and reformat into one column as in a newspaper. Unfortunately, the layout manager is not sure exactly how wide she wants the column to be so she wants you to give her some samples of different widths. The column width is a variable your program will use to format the text.

Write a program to format a paragraph of text into one columns for a given total column width. The user will select the width (in characters) that the page should be. You can make the following assumptions:

There will be no more than 25 rows of input lines or 25 rows of output. For this problem, place the text in DATA STATEMENTS so it needs to be entered only once.

Test you program with the first paragraph above. Run the program with column width = 60 and column width = 40.

Sample Run

Enter a column width: 40
You are a document layout specialist
and you are given text to input and
reformat into one column as in a
newspaper. Unfortunately, the layout
manager is not sure exactly how wide
she wants the column to be so she wants
you to give her some samples of
different widths. The column width is a
variable your program will use to
format the text.

57. DIGIT STRING

Suppose you translate a number it into a string of digits spelled out, one word for each digit, followed by a single space. For example, the number 407 becomes the digit string: "FOUR ZERO SEVEN".

Write a program to accept a positive number and print out its DIGIT STRING. The program should work for decimal numbers as shown in the Sample Run.

Sample Run

Enter a positive number: 407.8
The Digit String = FOUR ZERO SEVEN . EIGHT

Test your program with the following numbers:
79   66.2   9786.45231

58. CIRCULAR NUMBERS

A whole number is said to be CIRCULAR if, when you multiply the number by its units decimal digit, the result is the number with its decimal digits rotated to the right, with the units digit becoming its high-order digit. For example, 102564 is a circular number because in the multiplication:

```
102564
   x4
--------
410256
```

can be formed by taking 4 at right of 102564 and moving it to the left to get 410256.

Write a program to test a number from 1 to 999,999 to see if it is a CIRCULAR NUMBER.

Sample Run

Enter your number less than 1,000,000 : 102564
102564 is a CIRCULAR NUMBER

Enter a number less than 1,000,000 : 123456
123456 is NOT a CIRCULAR NUMBER

Test your program with inputs 102564, 11111, 113793.

59. ORDERING FRACTIONS

A fraction is the quotient of two integers M/N. Consider two fractions 1/2 and 3/8 which one is largest? When these two fractions are ordered from lowest to highest they would appear as follows:

$$3 / 8 < 1 / 2$$

Write a program that accepts two fractions, each entered as a pair N,M , and prints out the fractions in ordered form as above. If the fractions are equal, it should say so and always put the fraction with the lowest denominator on the left. For example if N,M = 6,12 and P,Q = 2,4 then the output would be:
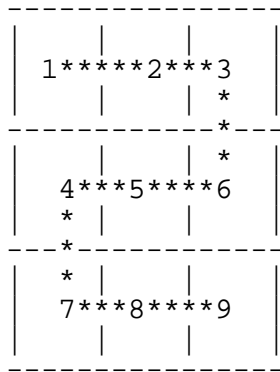
$$2 / 4 = 6 / 12$$

Sample Run

Enter a fraction M/N as M,N : 1,2
Enter a fraction P/Q as P,Q : 3,8
3 / 8 < 1 / 2

Test your program with the fractions:

2,3 and 4,7
615, 2280 and 123, 456
12345,34567 and 34,57

60. VALID WALKS

A 3x3 square is divided into 9 unit cells and numbered from left to right row by row as shown below . It is possible to walk from cell 1 to cell 9 by stepping from one cell to a neighboring cell (one that shares a common side) until you have arrived at cell 9 never steping on a cell more than once. A VALID WALK is described as a list of nine digits beginning with 1 and ending with 9 as follows: 123654789. Notice that no digits are repeated and all neighboring digits are neighboring cells. Walks that use fewer than all 9 cells are valid too. For example, 12369 is a VALID WALK. Walks that don't begin at 1 and end at 9 are not valid.

```
----------------
|    |    |    |
| 1*****2***3  |
|    |    | *  |
-----------*----
|    |    | *  |
| 4***5****6   |
| *  |    |    |
---*------------
| *  |    |    |
| 7***8****9   |
|    |    |    |
----------------
```

Write a program that will tell whether a proposed walk in this 3x3 block is a VALID WALK.

Sample Runs

Enter a walk : 1 2 3 6 5 4 7 8 9
123654789 is a VALID WALK.

Enter a walk: 1 2 3 4 5 6 7 8 9
123456789 is NOT a VALID WALK.

Test your program with the following walks:
123654789, 12369, 123569, 2369, 1252589, 147852369

Your program may not store all the valid walks worked out my hand and
simply look them up. But you may store the valid steps in an array A(I,J) where A(I,J) = 1 means you may step from cell I to cell J where I =1 to 8 and J=2 to 9.