

The 7th Annual Newport News Computer Challenge

Wednesday, March 5, 2008

Team Packet

C++ Problems



The 7th Annual Newport News Computer Challenge Wednesday, March 8, 2007

C++ Problems

Ugly Numbers ~ 10 points

The Chinese Animal Zodiac Year Problem ~ 10 points



Bipartite Numbers ~ 20 points

The Chinese Animal Zodiac Age Problem ~ 20 points



The 7th Annual Newport News Computer Challenge Wednesday, March 5, 2008

Ugly Numbers (10 points)



Ugly numbers are numbers whose only prime factors are 2, 3 or 5.

The sequence

1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, ...

shows the first 11 ugly numbers. By convention, 1 is included.

Write a program that prompts the user to input a positive integer *n* and outputs the *nth* ugly number followed by the next four ugly numbers.



The Chinese Animal Zodiac Year Problem (10 points)

In the Chinese Animal Zodiac calendar, the years, for which we use numbers, are designated by twelve animals, beginning with the Rat:



Years are called "Year of the Rat", "Year of the Ox", etc.

When the "Year of the Boar" is reached, the next year is "Year of the Rat" again and the cycle repeats.

C++ ~ Newport News Computer Challenge 2008 Page 1 of 2 Although the Chinese New Year falls on different days yearly, somewhere between late January and early February based on the cycles of the moon, for the purposes of this problem, we will assume that Chinese Animal Zodiac years correspond exactly to years on our Western calendar (so years begin on January 1).

1996 was "The Year of the Rat".

Write a C++ program that allows the user to input a Western numerical year from 1500 to 2999 inclusive and then outputs the Chinese Animal Zodiac year in the format used in the sample run below. Use "was", "is", or "will be" properly. Replace "Sample" with your school's name.

Input repeats until a year outside the given range is entered.

Sample run:

Program to convert a Western Year to a Chinese Animal Zodiac Year. By the C++ team from Sample High School.

Enter a year (1500-2999, any other year to quit): 1500 1500 was the Year of the Monkey Enter a year (1500-2999, any other year to quit): 2006 2006 was the Year of the Dog Enter a year (1500-2999, any other year to quit): 2007 2007 is the Year of the Boar Enter a year (1500-2999, any other year to quit): 2008 2008 will be the Year of the Rat Enter a year (1500-2999, any other year to quit): 2999 2999 will be the Year of the Sheep Enter a year (1500-2999, any other year to quit): 3000 Press any key to continue . . .



The 7th Annual Newport News Computer Challenge

Wednesday, March 5, 2008

Bipartite Numbers (20 points)

A bipartite number is any positive integer that contains exactly 2 distinct decimal digits s and t such that s is not 0 and all occurrences of s precede all occurrences of t. For example 4444411 is bipartite (s is 4 and t is 1), So are 41, 10000000, and 5555556. However, neither 4444114 nor 44444 are bipartite.



Notice that the bipartite number 888800000 can be nicely described as 4 8's followed by 5 0's. You can express any bipartite number using four numbers: $m \ s \ n \ t$. We will call this format the "short format". The numbers s and t are the leading and trailing digits as described above, m is the number of times the digit s appears in the bipartite number, and n is the number of times the digit t appears.

You are to write a C++ program that accepts positive integers, or 0 to quit. After each positive integer, your program should display the smallest bipartite number, in "short format" of course, that is greater than and a multiple of the positive integer. If the user enters a negative number, just politely ask them to enter a positive integer again. If no bipartite number is found less that the maximum positive integer used by your C++ compiler, display an appropriate message.

Here is a sample run:

Bipartite Numbers. By the [your school's name here] team. Enter a positive integer, 0 to quit: -5Enter a positive integer, 0 to quit: 1234No bipartite number found less than 2147483647. Enter a positive integer, 0 to quit: 125The bipartite number that is greater than and a multiple of 125 is 500 = 1 5 2 0Enter a positive integer, 0 to quit: 17502The bipartite number that is greater than and a multiple of 17502 is 77778888 = 4 7 4 8Enter a positive integer, 0 to quit: 2005The bipartite number that is greater than and a multiple of 2005 is 222555 = 3 2 3 5Enter a positive integer, 0 to quit: 0 Press any key to continue . . .



The 7th Annual Newport News Computer Challenge Wednesday, March 5, 2008

The Chinese Animal Zodiac Age Problem (20 points)

This problem uses the same Chinese Animal Zodiac described in detail in the Chinese Animal Zodiac Year Problem.



The animal signs also serve a useful social function for finding out people's ages. Instead of asking directly how old a person is, people often ask what is his or her animal sign. This would place that person's age within a cycle of 12 years, and with a bit of common sense, we can deduce the exact age.

Given a person's age (under 100 years old) as one of these descriptions:

Description	Years Old
child	1 to 12 years old
teenager	13 to 19 years old
twenty-something	20 to 29 years old
thirty-something	30 to 39 years old
etc. through ninety-something	

and given the Chinese Animal Zodiac year in which the person was born and the current Chinese Animal Zodiac year, tell the person's exact age. Remember to include the fact that in China, when a baby is born, it is considered to be 1 year old.

Samples:

A "child" born in the "Year of the Ox" and it is now the "Year of the Dog" is 10 years old.

A "teenager" born in the "Year of the Ox" and it is now the "Year of the Rabbit" is 15 years old.

A "thirty-something" person born in the "Year of the Ox" and it is now the "Year of the Rat" is 36 years old.

Be careful! Some combinations are not possible. For example, if a teenager was born in the "Year of the Rat" and it is now the "Year of the Dog", the teenager could only be 11 or 23 and thus could not be a teenager according to our chart. In such cases, your program should report "Not Possible!".

A sample run is provided on the next page.

Sample run:

The Chinese Zodiac Age Problem. By the C++ team at Sample High School. Age Descriptions: 0 - child 1 to 12 years old. 13 to 19 years old. 1 - teenager 2 - twenty-something 3 - thirty-something 30 to 39 years old. 4 - forty-something 40 to 49 years old. 50 to 59 years old. 5 - fifty-something 5 - fifty-something50 to 59 years old.6 - sixty-something60 to 69 years old.7 - seventy-something70 to 79 years old.0 - sixty-something20 to 20 years old. 8 - eighty-something 80 to 89 years old. 9 - ninety-something 90 to 99 years old. Enter your age description. (0-9) 5 Chinese Animal Zodiac Years. 0 - Year of the Rat 1 - Year of the Ox 2 - Year of the Tiger 3 - Year of the Rabbit 4 - Year of the Dragon 5 - Year of the Snake 6 - Year of the Horse 7 - Year of the Sheep 8 - Year of the Monkey 9 - Year of the Rooster 10 - Year of the Dog 11 - Year of the Boar Enter the Chinese Zodiac year in which you were born. (0-11) 10 Enter the current Chinese Zodiac year. (0-11) 2 A fifty-something person born in the Year of the Dog and it is now the Year of the Tiger is 53 years old. Press any key to continue . . .



The 7th Annual Newport News Computer Challenge

Wednesday, March 5, 2008

C++ - Ruberics For Teams

Ugly Numbers (10 points)

	Max Points
Heading displays program name and team's name.	1
Prompts user to input a positive integer <i>n</i> .	1
Accepts the positive integer without crashing.	1
Outputs the <i>nth</i> ugly number	3
followed by the next four ugly numbers.	4
TOTAL	10

Chinese Animal Zodiac Year Problem (10 points)

	Max Points
Heading displays program name and team name.	1
Correctly prompts user to enter a year from 1500 to 2999, any other year to quit.	1
Displays the correct answer for any valid western year. ("Rat", "Ox", etc.)	5
Displays the correct answer correctly formatted regardless of "was", "is", or "will be".	1
Displays the correct answer correctly formatted including "was", "is", or "will be".	1
If displays a correct answer for years in range, quits if any other year is entered.	1
TOTAL	10

Bipartite Numbers (20 points)

	Max Points
Heading displays program name and team's name.	1
Prompts user to input a positive integer <i>n</i> and zero (0) to quit.	1
Quits if user enters 0.	1
Rejects negative numbers and re-asks.	1
Displays message if no bipartite number less that maximum integer is found.	3
Outputs the smallest bipartite number that is greater than and a multiple of the positive integer. If only one format is displayed (integer or "short format") award 6 points instead of 12.	12
Repeats if user enters a positive number.	1
TOTAL	20

Chinese Animal Zodiac Age Problem (20 points)

	Max Points
Heading displays program name and team name.	1
Displays the list of Age Descriptions.	1
Prompts for and accepts input for the Age Description.*	1
Displays the Chinese Animal Zodiac Years.	1
Prompts for and accepts input for the Chinese Animal Zodiac year of birth.*	1
Prompts for and accepts input for the current Chinese Animal Zodiac year.*	1
Calculates and displays the correct numerical age.	10
Calculates and displays the correct numerical age with correct echoing of input such as in the sample run.	2
Correctly detects impossible combinations and displays "Not Possible!"	2
TOTAL	20

* May use other methods of input besides input by numbers but the prompts must be very clear and user-friendly.