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CPS 150 02 – Algorithms and Programming 1

Lab 12

10/29/20

**Problem 1 Algorithm**

Using For Loop:

1. Start the program
2. Import the scanner
3. Prompt the user to enter an n value for when the sequence should end
4. Declare an int variable for the end n value
5. Declare int variables for the second most recent and most recent terms and initialize them to 0 and 1, respectively
6. Create a for loop that starts with n equal to 1 and goes until n is greater than the value entered by the user – increment n by 1 each time through the loop
7. In the for loop, print the second most recent term
8. Declare a variable for the sum of the series and set it equal to the second most recent term plus the most recent term
9. Reassign the second most recent term the value of the most recent term
10. Reassign the most recent term the value of the series sum
11. End the for loop
12. End the program

Using While Loop:

1. Start the program
2. Import the scanner
3. Prompt the user to enter an n value for when the sequence should end
4. Declare an int variable for the end n value
5. Declare int variables for the second most recent and most recent terms and initialize them to 0 and 1, respectively
6. Declare an int variable for a term counter that starts at 1
7. Use a while loop that goes until n is greater than the value entered by the user
8. In the while loop, print the second most recent term
9. Declare a variable for the sum of the series and set it equal to the second most recent term plus the most recent term
10. Reassign the second most recent term the value of the most recent term
11. Reassign the most recent term the value of the series sum
12. Increment n by 1
13. End the for loop when i is greater than the end n value
14. End the program

**Problem 1 Running Screenshot**

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**Problem 1 Code**

For Loop:

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FibonacciForLoop: number ; number

program takes in an n value where the Fibonacci Series will end

and calculates/prints out the sum of the series using a for loop

ex1: user inputs 9 - program outputs 0 1 1 2 3 5 8 13 21

ex2: user inputs -4 - program outputs nothing

ex3: user inputs 101.65 - program outputs error

ex4: user inputs x - program outputs error

ex5: user inputs 4 - program outputs 0 1 1 2

ex6: user inputs 2 - program outputs 0 1

\*/

import java.util.Scanner;

public class FibonacciForLoop {

public static void main(String [] args){

//import scanner

Scanner input = new Scanner(System.in);

//prompt user to enter end n value and declare an int variable for this value

System.out.print("Please enter the n value: ");

int endN = input.nextInt();

//declare int variables for the n-2 term and the n-1 term

int twoTermsAgo = 0;

int oneTermAgo = 1;

for(int n = 1; n <= endN; n++){

//print the n-2 term

System.out.print(twoTermsAgo + " ");

//declare an int variable for the sum and print the sum

int sum = twoTermsAgo + oneTermAgo;

//reassign n-2 term to the n-1 term and the n-1 term to sum

twoTermsAgo = oneTermAgo;

oneTermAgo = sum;

}

}

}

While Loop:

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FibonacciWhileLoop: number ; number

program takes in an n value where the Fibonacci Series will end

and calculates/prints out the sum of the series using a while loop

ex1: user inputs 9 - program outputs 0 1 1 2 3 5 8 13 21

ex2: user inputs -4 - program outputs nothing

ex3: user inputs 101.65 - program outputs error

ex4: user inputs x - program outputs error

ex5: user inputs 4 - program outputs 0 1 1 3

ex6: user inputs 2 - program outputs 0 1

\*/

import java.util.Scanner;

public class FibonacciWhileLoop {

public static void main(String [] args){

//import scanner

Scanner input = new Scanner(System.in);

//prompt user to enter end n value and declare an int variable for this value

System.out.print("Please enter the n value: ");

int endN = input.nextInt();

//declare int variables for the n-2 term and the n-1 term

int twoTermsAgo = 0;

int oneTermAgo = 1;

//declare an int variable for the counter n

int n = 1;

while(n <= endN){

//print the n-2 term

System.out.print(twoTermsAgo + " ");

//declare an int variable for the sum and print the sum

int sum = twoTermsAgo + oneTermAgo;

//reassign n-2 term to the n-1 term and the n-1 term to sum

twoTermsAgo = oneTermAgo;

oneTermAgo = sum;

//increment n

n++;

}

}

}

**Problem 2 Algorithm**

1. Start the program
2. Import the scanner
3. Prompt the user to enter an n value – the factorial of n will be found
4. Declare an int variable to store the value of n
5. Initialize the value of the factorial to 1 – this is because the 0 factorial is 1
6. Use an if statement to check if the n value is greater than or equal to 0 (can’t take factorial of a negative) – if it is, go through for loop, otherwise print an error message
7. Create a for loop starting with int i equal to 1 and going until i is less than or equal to n – increment i by one each time through the loop
8. In the for loop, multiply the factorial value by i and reassign the variable the new value
9. Once the for loop is finished, print the factorial
10. End the for loop when i is greater than n
11. End the program

**Problem 2 Running Screenshot**

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**Problem 2 Code**

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FactorialForLoop: number ; number

program takes in an n value and uses a for loop to calculate/print

the factorial of n (ex: n=3, 3!=3\*2\*1)

ex1: user inputs 4 - program outputs 24

ex2: user inputs 11 - program outputs 39916800

ex3: user inputs 101.65 - program outputs error

ex4: user inputs x - program outputs error

ex5: user inputs -5 - program outputs Please enter an integer greater than or equal to 0

ex6: user inputs 0 - program outputs 1

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import java.util.Scanner;

public class FactorialForLoop {

public static void main(String [] args){

//import scanner

Scanner input = new Scanner(System.in);

//prompt the user to enter an n value and declare an int variable to store the value

System.out.print("Please enter your n value: ");

int n = input.nextInt();

//initialize a variable for factorial

int factorial = 1;

//use if statement to check if n is greater than or equal to 0 and print error statement if it isn't

if(n >= 0) {

//use for loop to multiply by each number up to n

for (int i = 1; i <= n; i++){

factorial = factorial \* i;

}

}

else{

System.out.println("Please enter an integer greater than or equal to 0");

}

//print the factorial of n

System.out.println("The factorial is " + factorial);

}

}

**Problem 3 Algorithm**

1. Start the program
2. Import the scanner
3. Prompt the user to enter a value that they want to check
4. Declare an int variable for the number the user inputs
5. Declare a boolean variable for whether or not the number is prime – it should originally be set to false if the number is less than 2 (2 is the lowest prime number), otherwise it should be set to true
6. Use a for loop to check if the number is divisible by anything other than 1 and itself – set int i equal to 2 and go until i is less than or equal to the number divided by 2, increment i by 1 each time
7. Inside the for loop, declare an int variable for the remainder and set it equal to the number % i.
8. Use an if statement to check if the remainder variable is equal to 0, and if it is, change the prime variable to false
9. End the for loop when i is greater than the number divided by 2
10. If the value of the prime variable is true, then print a message saying that the number is a prime number – otherwise, print a message saying the number is not a prime number
11. End the program

**Problem 3 Running Screenshot**

**Text

Description automatically generated**

**Problem 3 Code**

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PrimeNumber: number ; string

program takes in an integer from the user and determines/prints

out whether or not the number is a prime number

ex1: user inputs 4 - program outputs 4 is not a prime number

ex2: user inputs 11 - program outputs 11 is a prime number

ex3: user inputs 101.65 - program outputs error

ex4: user inputs x - program outputs error

ex5: user inputs -5 - program outputs -5 is not a prime number

ex6: user inputs 7757 - program outputs 7757 is a prime number

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import java.util.Scanner;

public class PrimeNumber {

public static void main(String [] args){

//import scanner

Scanner input = new Scanner(System.in);

//prompt the user to enter a number they want to check and declare an int variable for the value

System.out.print("Please enter an integer: ");

int userNumber = input.nextInt();

//declare a boolean variable for whether or not the number is prime - false if number is less than 2, true otherwise

boolean prime;

if(userNumber < 2) {

prime = false;

}

else{

prime = true;

}

//use a for loop to check if the number is divisible by anything other than 1 and itself

for(int i = 2; i <= userNumber / 2; i++){

//declare an int variable for remainder - will be used to check if number evenly divides

int remainder = userNumber % i;

//use if statement to see if number evenly divides - if so, it's a factor and the number isn't prime

if(remainder == 0){

//change prime to false;

prime = false;

}

}

//use if statement to print whether or not the number is prime

if(prime){

System.out.println(userNumber + " is a prime number");

}

else{

System.out.println(userNumber + " is not a prime number");

}

}

**Problem 4 Algorithm**

1. Start the program
2. Initialize an int variable for the product of the two terms
3. Use nested for loops with variables i and j (both going from 1 to 10 and incrementing by 1 each time) to calculate the results of numbers 1-10 \* 1-10
4. In the inner loop, multiply i and j and reassign the product variable this value
5. Also in the inner loop, print the product of the two terms
6. In the outer loop, print a new line
7. End the for loops when i and j are greater than 10
8. End the program

**Problem 4 Running Screenshot**

**Graphical user interface, text

Description automatically generated**

**Problem 4 Code**

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MultiplicationTable: no inputs ; 100 numbers

program takes calculates/prints out a 10 by 10 multiplication table

no examples needed - only one output - results of all products 1-10\*1-10

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public class MultiplicationTable {

public static void main(String [] args){

//initialize an int variable for product

int product;

//use a nested for loop to print the results of numbers 1-10 \* numbers 1-10

for(int i = 1; i <= 10; i++){

for(int j = 1; j <= 10; j++){

//multiply i and j

product = i \* j;

//print product

System.out.print(product + " ");

}

System.out.println("");

}

}

}