

Assignment 2

Enrique Saracho Felix

100406980

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Exercise 1

Program CountingOnes

Purpose: Count the number of 1s in a binary number which is converted from a decimal number entered by the user.

Input: Decimal number of type integer. The program outputs a message to the user to enter an integer number between 0 and 99. If the value entered by the user doesn't fit the criteria, then it will display an error message, and prompt the user to enter the value again. The value will be stored in a variable called *num*.

Output: Decimal number of type integer. The program will display the *count* variable containing the number of 1s in the binary equivalent of the input value.

Calculations: Conversion of the user input from decimal to binary. We divide in a loop the input by 2 until the answer is 0. We also keep track of the remainder of each division.

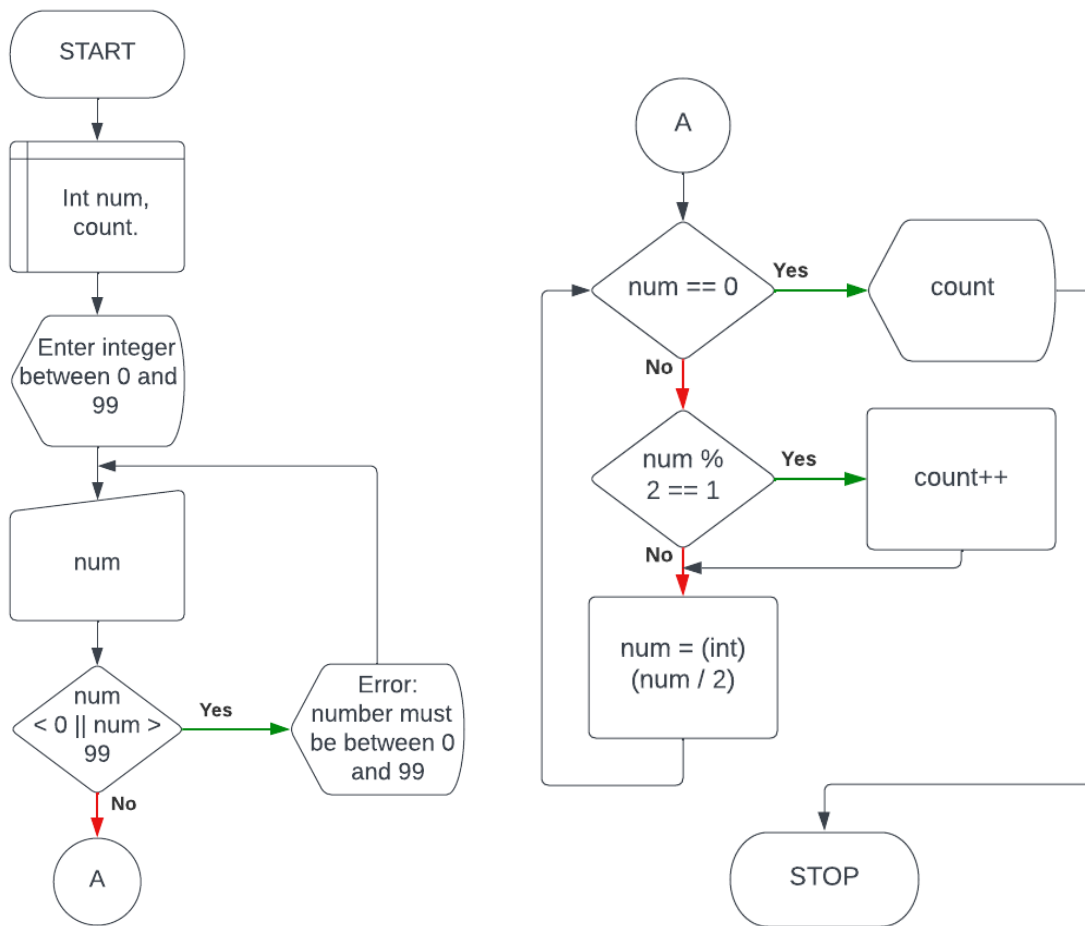
For the remainder: $\text{num} \% 2 == 1$

For the division: $\text{num} = (\text{int})(\text{num} / 2)$

Variables: *num*: Type integer. Contains the input value.
count: Type integer. Counts the number of 1s in the binary number.

Constants: Not needed.

Flowchart:



Trace tables:

Algorithm trace table:

#	num	count	Output
0	-5	0	Error
1	14	4	4
2	100	0	Error
3	0	0	0
4	5	2	2
5	30	4	4

Loop trace table (example with num = 5):

Iteration	count	num
0	0	5
1	1	2
2	1	1

3	2	0
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Loop trace table (example with num = 30):

Iteration	count	num
0	0	30
1	0	15
2	1	7
3	2	3
4	3	1
5	4	0

Loop trace table (example with num = 14):

Iteration	count	num
0	0	14
1	0	7
2	1	3
3	2	1
4	3	0

Exercise 2

Program Palindrome

File name: asgn2\Palindrome.java

Purpose: To generate a random three-digit integer and determine if it's a palindrome number.

Input: Not needed.

Output: A string containing the random generated number and a Boolean value representing whether it's a palindrome or not.

Pseudocode:

Algorithm (program name)

START

1. Declare variable int *num*.
2. Generate a random integer between 100 and 999 and assign it to *num*.
3. If $\text{num} \% 10 = \text{rounded down}(\text{num} / 100)$
 - a. Print num is a palindrome.
4. Else
 - a. Print num is not a palindrome.

END (program name)

Trace table:

num	$\text{num} \% 10 = \text{num} / 100$	Output
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123	False	123 is not a palindrome.
454	True	454 is a palindrome.

Exercise 3

Program CardGame

File name: asgn2\CardGame.java

Purpose: To simulate picking a card from a deck of 52 cards.

Input: Not needed.

Output: A string containing the name of the card that has been picked.

Pseudocode:

Algorithm (program name)

START

1. Declare variable cardNum.
2. Generate random number between 0 and 51 and assign it to cardNum.
3. If cardNum is:
 - a. 0 then:
 - i. Display Ace of Hearts
 - b. 1 then:
 - i. Display 2 of Hearts
 - c. 2 then:
 - i. Display 3 of Hearts
 - d. 3 then:
 - i. Display 4 of Hearts
 - e. 4 then:
 - i. Display 5 of Hearts
 - f. ...

END (program name)

Exercise 4

Program GuessingGame

File name: asgn2\GuessingGame.java

Purpose: To simulate a game where the program generates a random number between 1 and 10, and the user must guess what number it is. The program must then give feedback to the user according to the result.

Input: Integer between 1 and 10. It will be stored in a variable called *userNum*.

Output: Result of the game including the randomly generated number *ranNum*, a message indicating if the user's guess was successful, if it was close or not and if so, a better luck next time message.

Pseudocode:

Algorithm (program name)

START

1. Integer userNum, ranNum.
2. userNum = user input.
3. If userNum < 1 or userNum > 10 then:
 - a. Display error message.
4. ranNum = random number between 1 and 10.
5. If userNum = ranNum then:
 - a. Display 'you win' message.
6. Else:
 - a. Display ranNum.
 - b. If absolute(ranNum – userNum) <= 3 then:
 - i. Display 'it was close' message.
 - c. Else:
 - i. Display 'you missed by a mile' message.
 - d. Display 'better luck next time' message.

END (program name)