

Question 1a)

What is printed by the following Java program?

```
int s;  
int r;  
int i;  
  
int [] x = {4, 8, 2, -9, 6};  
s = 1;  
r = 0;  
i = x.length - 1;  
while (i > 0)  
{  
    s = s * -1;  
    i = i - 1;  
    r = r + s * x[i];  
}  
System.out.println(r);
```

- a) -13 b) 20 c) -9 d) -21 e) 11 f) 7

Trace of program

	x	s	r	i
Initial values	?	?	?	?
x = {4, 8, 2, -9, 6}	{4, 8, 2, -9, 6}			
s = 1		1		
r = 0			0	
i = x.length - 1				4
while (i > 0): true				
s = s * -1		-1		
i = i - 1				3
r = r + s * x[i]			9	
while (i > 0): true				
s = s * -1		1		
i = i - 1				2
r = r + s * x[i]			11	

Trace of program

	x	s	r	i
Values from previous table	{4, 8, 2, -9, 6}	1	11	2
while (i > 0): true				
s = s * -1		-1		
i = i - 1				1
r = r + s * x[i]			3	
while (i > 0): true				
s = s * -1		1		
i = i - 1				0
r = r + s * x[i]			7	
while (i > 0): false				
System.out.println(r)				

Question 1a)

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{  
    s = s * -1;  
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    r = r + s * x[i];  
}  
System.out.println(r);
```

$r = -(-9) + 2 - 8 + 4$

- a) -13 b) 20 c) -9 d) -21 e) 11 f) 7

Question 1b)

- The array of integers "a" (type int) initially contains {1, 3, 8}. Only **one** of the following Boolean expressions evaluates to false. Circle the letter next to the expression that evaluates to false.

- a) `(a[1] < 3) || ((a[1] / 2) == 1)`
- b) `!((a[0] % a[2]) == (a[0] % a[1]))`
- c) `!(!(false) && (a[2] < a[1]))`
- d) `Math.pow(a[1],2) > a[2]`
- e) `Math.abs(a[0] - a[1] + 2) <= 0`

Question 1b)

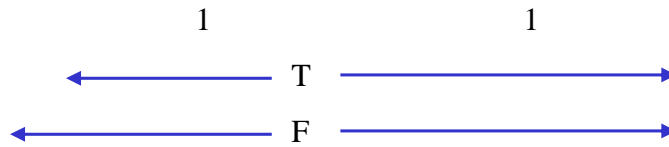
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- 3
3
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- F
1
- ← T →
← T →

Question 1b)

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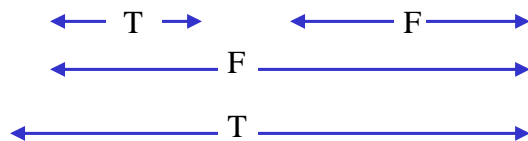
b) $!((a[0] \% a[2]) == (a[0] \% a[1]))$



Question 1b)

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Question 1b)

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3 8
d) `Math.pow(a[1],2) > a[2]`

9
←----- T -----→

Question 1b)

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1 3
e) `Math.abs(a[0] - a[1] + 2) <= 0`

←----- -2 -----→
←----- 0 -----→
←----- T -----→

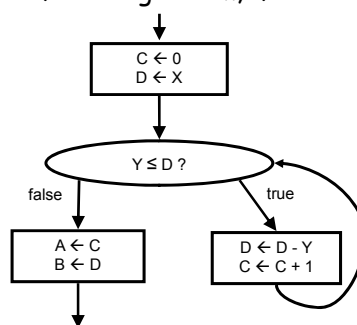
Question 1b)

- The array of integers "a" (type int) initially contains {1, 3, 8}. Only **one** of the following Boolean expressions evaluates to false. Circle the letter next to the expression that evaluates to false.

- a) $(a[1] < 3) \ || \ ((a[1] / 2) == 1)$
- b) $!((a[0] \% a[2]) == (a[0] \% a[1]))$**
- c) $!(!(false) \ \&\& \ (a[2] < a[1]))$
- d) $\text{Math.pow}(a[1], 2) > a[2]$
- e) $\text{Math.abs}(a[0] - a[1] + 2) \leq 0$

Question 1c)

- Suppose that X and Y are given integers; C and D are intermediates; A and B are results. What will the values of A and B at the end of this algorithm, if the initial values are X = 8 and Y = 3?

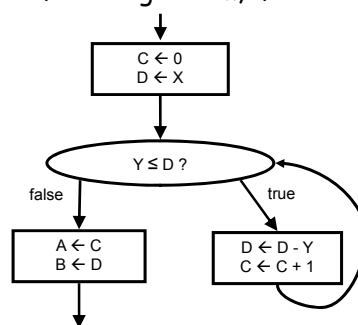


Trace of algorithm

	X	Y	C	D	A	B
Initial values	8	3	?	?	?	?
$C \leftarrow 0$			0			
$D \leftarrow X$				8		
$Y \leq D$: true						
$D \leftarrow D - Y$				5		
$C \leftarrow C + 1$			1			
$Y \leq D$: true						
$D \leftarrow D - Y$				2		
$C \leftarrow C + 1$			2			
$A \leftarrow C$					2	
$B \leftarrow D$						2

Question 1c)

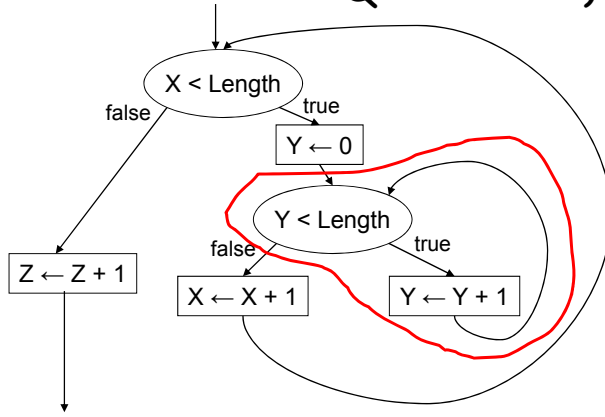
- Suppose that X and Y are given integers; C and D are intermediates; A and B are results. What will the values of A and B at the end of this algorithm, if the initial values are $X = 8$ and $Y = 3$?



This algorithm calculates $A = X/Y$ and $B = X\%Y$

$A = 2, B = 2$

Question 2a)

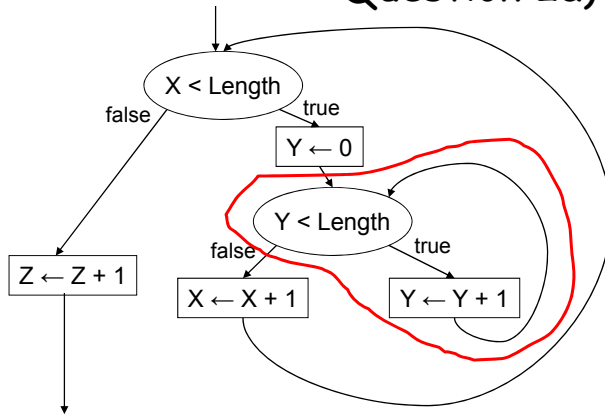


```
while ( x < length )  
{  
  y = 0;  
  if ( y < length )  
  {  
    y = y + 1;  
  }  
  else  
  {  
    x = x + 1;  
  }  
}  
z = z + 1;
```

Briefly, this translation of an algorithm body diagram is incorrect because ...

A loop has been translated as an if-else statement.

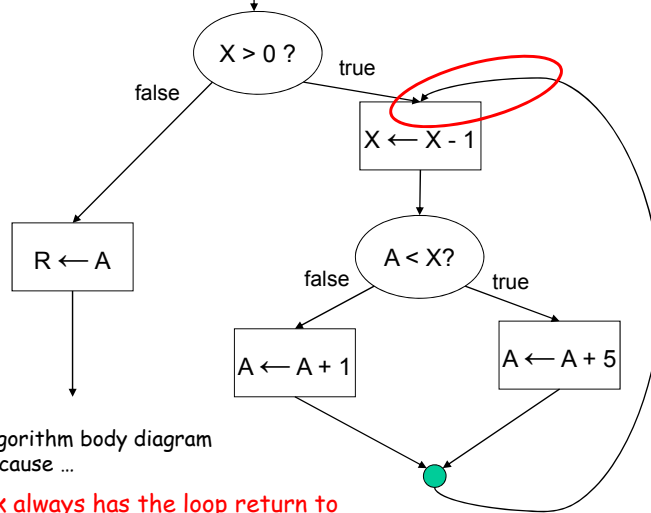
Question 2a)



```
while ( x < length )  
{  
  y = 0;  
  while ( y < length )  
  {  
    y = y + 1;  
  }  
  x = x + 1;  
}  
z = z + 1;
```

Correct translation

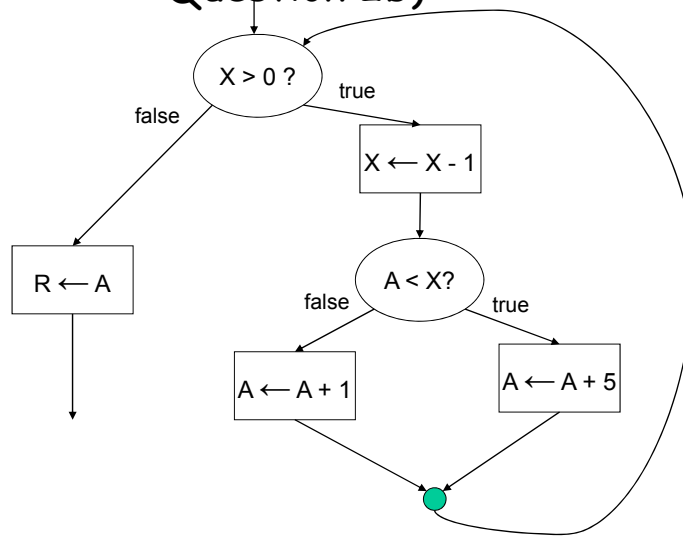
Question 2b)



Briefly, this algorithm body diagram is incorrect because ...

A loop block always has the loop return to the test. This could not be translated to Java.

Question 2b)



Corrected

Question 3) Translate to Java

GIVENS: X (*array of integers*)
 N (*number of items in array X*)
 V (*a limit value*)

INTERMEDIATES:
 Index (*index for array X going from 0 to N-1*)
 Sum (*sum of values in the array*)

RESULT:
 Exceeds (*Boolean: True if Sum > V and false otherwise*)

HEADER: Exceeds ← SumExceedsV(X, N, V)

Question 3 (first part)

```
import java.io.* ;

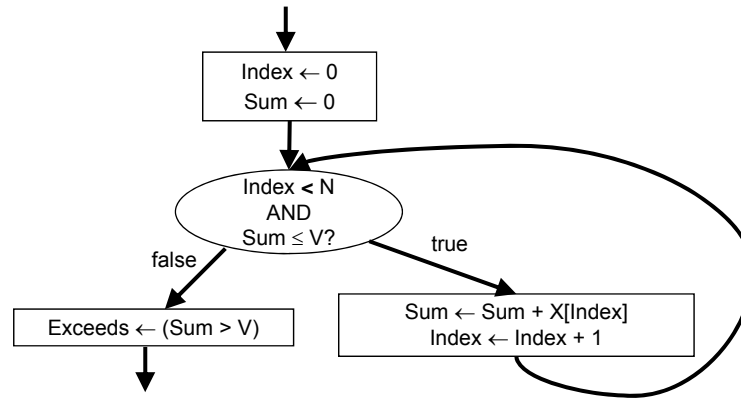
class exam2004Q3
{
    public static void main( String[] args ) throws IOException
    {
        // DECLARE VARIABLES / DATA DICTIONARY
        int [] x;        // GIVEN: array of integers
        int n;         // GIVEN : number of items in the array x
        int v;         // GIVEN : a limit value
        int index;     // INTERMEDIATE: index for array x
        int sum;       // INTERMEDIATE : sum of values in array x
        boolean exceeds; // RESULT: true if sum > v and false otherwise

        // READ IN GIVENS
        System.out.print( "Enter an array of integers: " );
        x = CS11100.readIntLine( );
        n = x.length;

        System.out.print( "Enter a limit value: " );
        v = CS11100.readInt( );
    }
}
```

Question 3 (second part)

BODY:



Question 3 (second part)

```
// BODY OF ALGORITHM
index = 0;
sum = 0;

while( index < n && sum <= v )
{
    sum = sum + x[index];
    index = index + 1;
}

exceeds = (sum > v);

// PRINT OUT RESULTS AND MODIFIEDS
System.out.println( "The result is: " + exceeds );
}
}
```

Question 4: Algorithm

- The Canadian income tax system has a series of tax brackets, where if a person's annual income is greater than or equal to the lower limit for the tax bracket, and less than the upper limit, the person is contained within the tax bracket.
- Suppose that you are given the upper and lower limits for a single tax bracket for a specific year, and an array `Income` of length `NumPersons` where each entry is the annual income for some person. Write an algorithm to determine the percentage of people that are contained in the tax bracket.

Question 4)

GIVENS:

Lower	(Tax bracket lower limit)
Upper	(Tax bracket upper limit)
Income	(Array of annual incomes)
NumPersons	(Size of array Income)

INTERMEDIATES:

Index	(Index for the Income array)
Count	(Number of people in the tax bracket)

RESULT:

Percentage	(Percentage of incomes within the tax bracket [0-100])
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HEADER:

Percentage	← PctInBracket (Lower, Upper, Income, NumPersons)
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Question 4)

BODY:

