

JBS Programming Bootcamp

Tutorial 2 — Tools, Concepts and Sufficient Language for Thinking and Expressing Ideas Programmatically.

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Algorithms and Problem-Solving

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Section A: Introduction.

1. Google the following terms:

Commutative Law, Associative Law, and Distributive Law; and determine which of the following arithmetic, Boolean, and relational operations are commutative, associative, and/or distributive. In each case, explain and give an example.

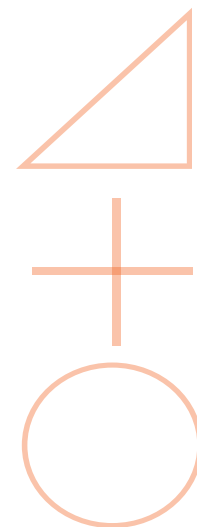
- (a) Addition, subtraction.
- (b) Multiplication and division.
- (c) =, <, >, >=, ==, <>
- (d) AND (^), OR (v), NOT (~)

(Note that some operators may obey more than one of these Laws.)

2. Precedence of operators and statement evaluations. What is the output of the following expressions and why? (Google: “precedence of logical operators” for 2b):

- (a) $3 - 4 * 2 / 4 - 9 = ?$
- (b) $(19 > 12) \text{ OR } (5 \geq 64) \text{ AND NOT (true)} = ?$

Note: NOT > AND > OR



3. Conjunction versus Disjunction: What do these terms mean? (Use Google here and take notes)

Reference:

Disjunction: <https://www.mathgoodies.com/lessons/vol9/disjunction>

Conjunction: <https://www.mathgoodies.com/lessons/vol9/conjunction>

4. (a) What is the converse of a relational statement? (Use Google here and take notes)
- (b) Determine the converse of the following algorithmic fragment, and hence its alternate presentation:

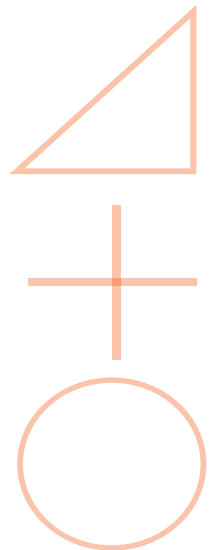
```
IF (a > b) THEN
    DISPLAY "a is larger"
ELSE
    DISPLAY "a is the smaller, or at least the same as b"
ENDIF
```

5. Determine the output of the following algorithmic segments:

```
FOR i = 2 TO 10 STEP 2
    DISPLAY CONCAT (i,i)
END FOR

FOR numbers = 5 TO -5 STEP 2
    DISPLAY numbers ^ 2
    DISPLAY numbers * numbers
END FOR
```

```
FOR x = 1 TO 20 STEP 1
    IF (x mod 2 == 0) THEN
        DISPLAY x
    END IF
END FOR
```



Section B: Evaluation of Algorithm Fragments

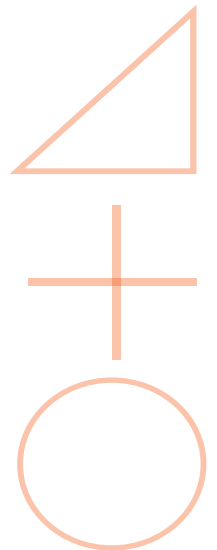
Determine the output of the following algorithm fragments.
START and STOP are commands used to start or end algorithms.

a) 1. START
2. FOR i = 1 To 10 STEP 1
 2.1 DISPLAY i
3. END FOR
4. STOP

b) 1. START
2. FOR i = 15 TO 1 STEP -1
 2.1 DISPLAY i
3. END FOR

c) 1. START
2. FOR I = 5 TO 30 STEP 5
 2.1 DISPLAY i
3. END FOR
4. STOP

d) 1. START
2. FOR i = 1 TO 10 STEP 1
 2.1 IF (i > 5) THEN
 2.1.1 DISPLAY "COVID OR NOT, WE WILL BE FINE!"
 2.2 ELSE IF THEN
 2.2.1 DISPLAY "FOR LOOPS ARE FUN"
 2.3 ENDIF
3. ENDFOR
4. STOP



Section C: Code Fragments

Evaluate the following.

(NOTE: Pick ANY five that you want the tutors to assist with, and SOLVE THE REST by yourself as practice problems.)

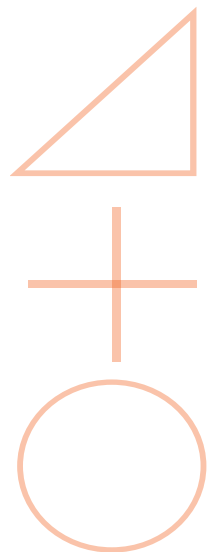
```
q = 10
x6 = 4
j5 = x6 + q
DISPLAY j5
```

```
q = 15
v = -7
b = -8
u8 = 11
v = (q + u8) + (v - b)
DISPLAY ABS(v, u8)
```

```
b = -8
m2 = -12
z = 20
u3 = 19
f = (z - b) + (m2 - u3)
DISPLAY z + CONCAT(f, f)
```

```
c = 3
j5 = 5
z = (c + j5)
WHILE (z > 5)
    DISPLAY z^2
    z = z - 2
END WHILE
DISPLAY z
```

```
j = 14
b = -8
x6 = (j + b)
DISPLAY x6
```



```

q = 15
g = -12
h2 = -2
m9 = 9
IF (m9 + h2) > 4 THEN
    x6 = (g + q) - (h2 - m9)
ELSE
    x6 = h2 + g
ENDIF
DISPLAY x6 + h2

```

```

g = -12
j = 14
t5 = 11
f = -7
DO
    q = (g + j) + (f - t5)
    DISPLAY CONCAT(g,t5,f), q
    f = f + 5
LOOP UNTIL (f > 0)

```

```

u = -7
v = -7
u = 0
q = (v - u)
FOR i = 2 to 6 STEP 3
    DISPLAY q^u - i
ENDFOR

```

```

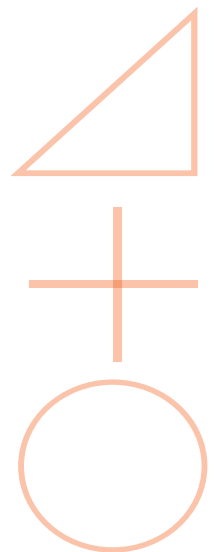
d = -15
u3 = 19
q = (d + u3)
DISPLAY q + ABS(d)

```

```

u = -7
j = 14
u = 0
z = 20
u8 = 11
u3 = (u8 - z) - (u + j)
DISPLAY u3

```



```
FOR k = 3 to 10 STEP -2
    DISPLAY k + z
ENDFOR
```

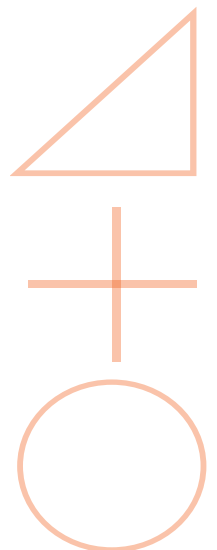
```
q = 15
j = 14
t4 = -9
g = (q + t4) + (j - 2)
DISPLAY g + t4 - q
```

```
g = -12
b = -8
t4 = -9
x6 = 4
f = ((b - t4) + (x6 + g))
DISPLAY f
```

```
d = -15
c = 3
j5 = (c - d)
r = CONCAT(d,";",j5,"",c)
DISPLAY SPLIT(r,";")
```

```
g = -12
m2 = -12
u8 = 11
f = -7
test = TRUE
DO
    c = (g - f) - (u8 + m2)
    test = NOT(test)
UNTIL (test = FALSE)
DISPLAY c
```

```
j = 14
d = -15
h2 = (d - j)
DISPLAY h2^0
```



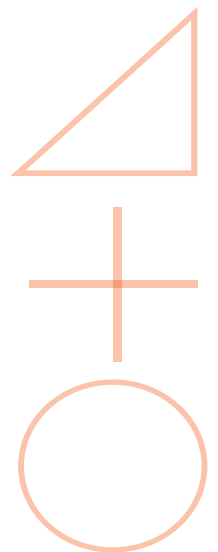
```
g = -12
d = -15
m9 = (g + 5) - (d - g)
DISPLAY m9
```

```
u = -7
c = CEIL(-2.49)
b = -8
v = (b + u - c)
DISPLAY u + v
```

```
v = -7
t5 = 11
m2 = -12
t4 = -9
u = (v - t4) - (t5 - m2)
DISPLAY u
```

```
u = -7
q = 15
u = 0
d = (q - u) + FLOOR(7.998)
DISPLAY d
```

```
q = 15
u8 = 11
j5 = 5
u3 = 19
DISPLAY u3
u3 = (j5 - u3) + (u8 + q)
DISPLAY j5
```



Section D: Complete Algorithm

- 1 JBS-GL Automobiles is a car dealership that buys and sells cars. This company only buys a car, if the car ticks the following boxes:

- (a) If it has not been more than three years since the car was manufactured,
- (b) If the car has not been involved in accident, and
- (c) If the car has not travelled more than 120,000km.

Write an algorithm that takes the necessary attributes of a car and determines if the management of JBS-GL Automobiles should buy the car or not.

- 2 Write an algorithm that uses an indicated loop structures to display the following sequences:

- (a) Use a FOR-Loop

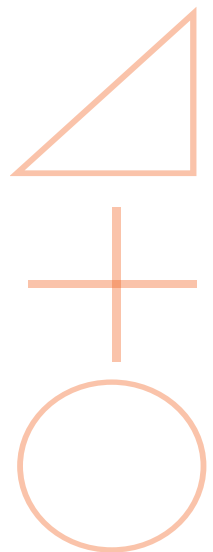
1	5
2	10
3	15
4	20
5	25

- (b) Use a WHILE-Loop

1	10	5.0
2	9	4.5
3	8	4.0
4	7	3.5
5	6	3.0
6	5	2.5
7	4	2.0
8	3	1.5
9	2	1.0
10	1	0.5

- (c) Use a DO-Loop

-3	12
-6	9
-9	6
-12	3



- (d) Determine the output of the following algorithm fragments.
START and STOP are commands used to start or end algorithms.

```
START
IF (i > 5)
    DISPLAY "COVID OR NOT, WE WILL BE FINE!"
ELSE
    DISPLAY "FOR LOOPS ARE FUN"
END IF
STOP
```

