JBS Innovation Lab, JBS Park, 69 Kingsway Avenue, Auckland Park, Johannesburg
https://www.uj.ac.za/members/prof-abejide-ade-ibijola/
orcid.org/0000-0001-9507-0455 | URL: abejide.org
jbs.bootcamp@uj.ac.za
+ 27 (011) 559 1989

JBS Johannesburg Business School | University of Johannesburg

Innovation Lab

Tutorials

JBS. Programming Bootcamp

Tutorial 1 — Basis

Trainer: Prof. Abejide Ade-Ibijola

Algorithms and Problem-Solving

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Section A: Discussions

1. What is a logical or Boolean value? Give examples. Contrast this with Logical operators. How many logical operators do we have?
2. In problem solving, what is the difference between Data structures and Algorithms?
3. Which stage of problem-solving deals with the question: *how will the program interact with the user?*
4. Typically, notations for mathematical algorithms are from set and _____ theory.
5. Is it correct to refer to algorithms and pseudocodes as the same, since a pseudocode is a way of writing an algorithm?
6. What is **pidgin code?**
7. Fact: concatenation joins strings, splitting separate strings. Discuss how you think a split function will work.
8. Apart from Iris Recognition, give TWO other examples of a computer solving problems in a different way to humans.
9. Differentiate between the **Syntax** and the **Semantics** of an algorithm.
10. Dry-running and Desk-checking are two different operations. True or False?
11. Apart for the examples presented in GRIT videos. Give two examples of algorithms as strategies.
12. **Further thoughts**: the Union of the set of all even numbers, and the set of all odd numbers, is **NOT** equal to the entire number system. Is this statement correct or wrong? Give a reason for your answer.

Section B: Evaluation of Expressions

1. Evaluate the following expressions:
   Fact: Floor operator returns the last whole number of a floating-point number. Ceiling operator does the opposite (approximates to the next whole number).

   (a) $\left\lfloor \frac{3}{2} \right\rfloor$ `= ?`

   (b) $\lfloor (20 \texttt{ mod } 5 + 0.29) \rfloor$ `= ?`

   (c) $\left\lfloor \frac{22}{7} \right\rfloor$ `= ?`

   (d) `"Tutorials are fun".IndexOf(" ") = ?`

   (e) `exp(1) - 2 = ?`

Section C: Logic and Truth Tables

0.1 Rules

AND rule: p AND q is TRUE if and only if both are TRUE. Otherwise, it is FALSE.
OR rule: p OR q is TRUE if either p is TRUE, OR q is TRUE, or both are TRUE.
NOT rule: If p is TRUE, NOT(p) is false; and vice-versa.

Note: The truth value of a statement is **true** or **false** which is denoted by **T** or **F**. A truth table is a listing of all possible combinations of the individual statements as **true** or **false**, along with the resulting truth value of the compound statements. Truth tables find many applications in computer programming.

0.2 Complete the following Tables

P	Q	NOT(P)	NOT(Q)	P AND Q	P OR Q	NOT (P) AND Q
T	T					
T	F					
F	T					
F	F					

P AND NOT(Q) OR P	(Q OR NOT(Q)) AND P	(NOT (P) AND NOT(Q)) OR P	**T** AND NOT (P OR Q)

F OR P AND (Q AND P)	P AND Q AND P OR Q	P OR P	Q OR Q

<u>Note:</u> Sometimes these operators have alternate mathematical notations.

NOT = ~, AND = ^, OR = v, ≡ means "is equivalent to"

0.3 Proofs (De Morgan's Laws)

With the aid of a truth table. Show that:
~(p ^ q) ≡ ~p v ~ q, i.e. "NOT (p AND q)" is equivalent to "NOT p OR NOT q."
~(p v q) ≡ ~p ^ ~ q, i.e. "NOT (p OR q)" is equivalent to "NOT p AND NOT q."