

Basic Programming

Teaching Team of Basic Programming 2023

The lecturer

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Introduction

Course Description

Basic Programming Course at a Glance

Basic Programming provides **knowledge** and **practice** of the basic concepts of algorithms and basic programming. By learning this course, students will have a fundamental competencies to **solve logic problems** and to **model the solutions** using **flowcharts and pseudocode**.

Learning Outcomes

After learning this course :

- Students must be able to understand the basic concepts of algorithms and to analyze logic problems in the form of algorithms [C2, A3] – Week 1-2
- Students must be able to understand and to explain Data Types, Variables, Input-output, Sequences, Operators (Arithmetic Assignment, Joint Assignment, Increment, Decrement, Relational, Logic, Conditional, Bitwise, Casting) and to apply them in writing algorithms [C4, A3] – Week 3
- Students must be able to explain the concepts of simple and nested selection, and to write selection algorithms to complete case studies using flowcharts [C4, A3, P2] – Week 5-6
- Students must be able to understand simple looping algorithms and Array 1, and to describe case study problems using flowcharts [C4, A3, P2] – Week 7-8
- Students must be able to understand the concept of 2-dimensional arrays and nested loops, and to complete case studies using Arrays – Week 10-11
- Students must be able to explain the concept of iterative and recursive functions, create / declare functions, call functions and are able to apply them in compiling problem solving algorithms [C4, A3, P2] – Week 13-14

The Subject

1. Basic Programming (Algorithm Concept)
2. Case study for Logic Problems
3. Data Type, Variable, Constant, Value, Expression, Input Output
4. Selection
5. Loop
6. Array
7. Function/Procedure

Learning Contract (1)

Week	Subject
Week – 1	Basic Programming
Week – 2	Git, Kanban Board, Explanation of Project
Week – 3	Data Type, Variable, Constant, Value, Expression, Input Output
Week - 4	Quiz 1
Week – 5	Selection 1
Week – 6	Selection 2
Week – 7	Loop 1
Week – 8	Midterm Exam
Week – 9	Array 1
Week – 10	Array 2
Week – 11	Loop 2 (Nested Loop)
Week – 12	Quiz - 2

Learning Contract (2)

Pertemuan	Materi
Week – 13	Function 1
Week – 14	Function 2
Week – 15	Progress of project
Week – 16	Progress of project
Week – 17	Final Exam

- **Quiz: 20 %**
- **Assignment: 20 %**
- **Midtrem Exam: 30%**
- **Final Exam: 30%**

Week #1

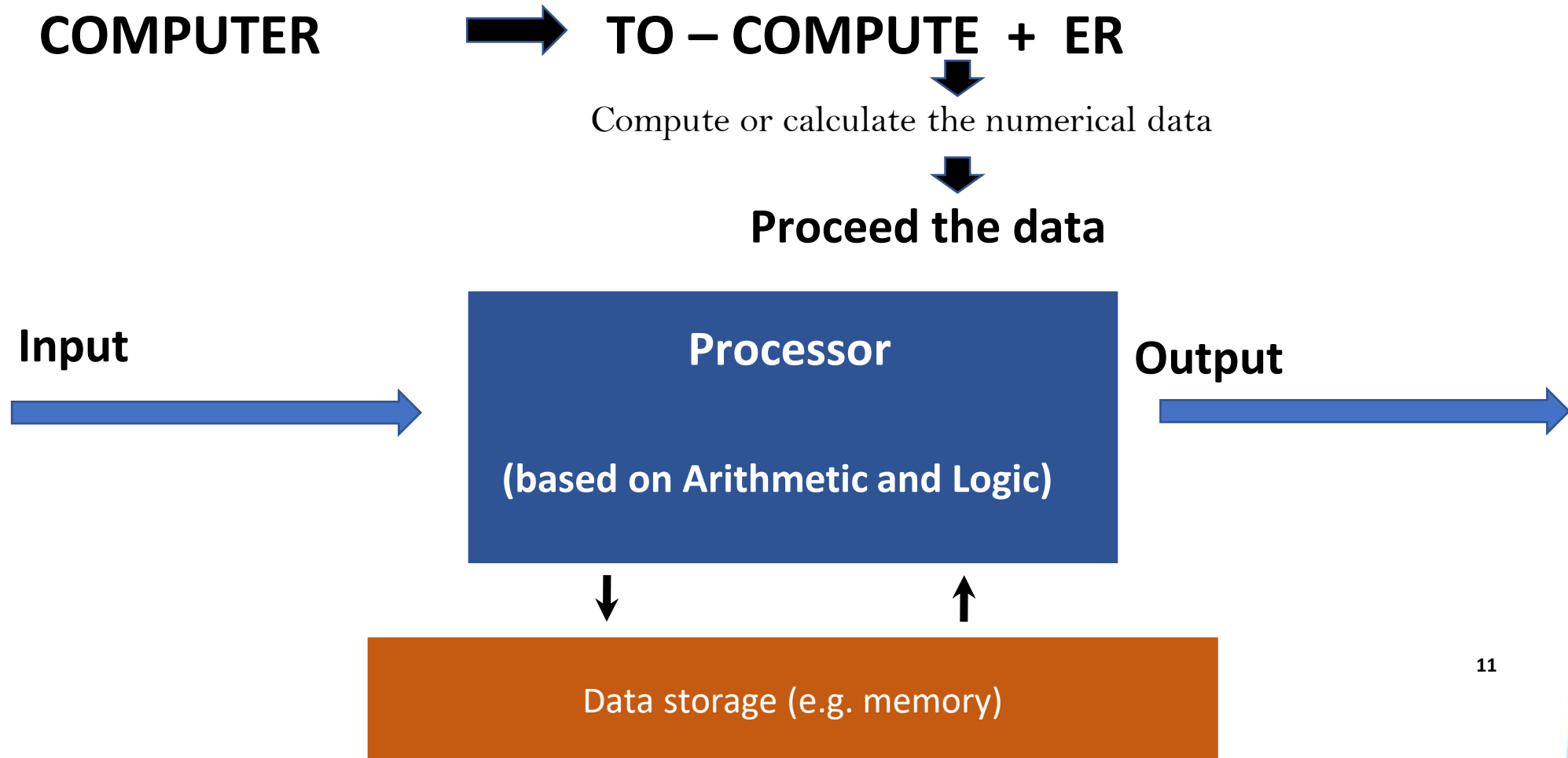
Basic Programming and Basic Algorithm

Learning Outcome

After finishing this topic, students must be able to:

Understand basic concept of basic algorithm and analyze the logic problems towards modelling the algorithm

Introduction - What Is a Computer?



Computer Software (Computer Program)

- Computer program (software) is collection of instructions for computer.
- Person can give the instruction to the computer through instructions in a software.
- Without any software, the computer will be only unusefull hardware that will not be able to perform or to proceed anything.
- Since the computer does not know the human language then the communication between person and computer will only work with *computer language*
- **Software developed by using a specific programming language.**

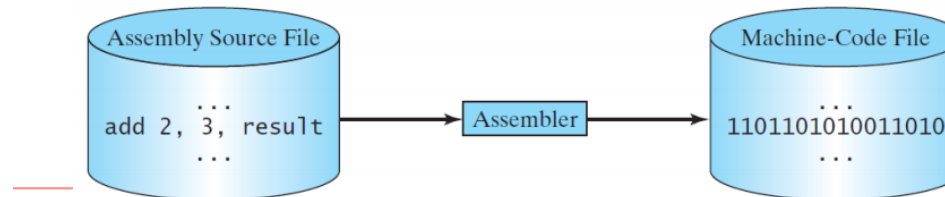


Computer Languages

Machine Language - Assembly Language - High Level Language

- Machine Language : the software is written in binary code.
 - E.g., addition of 2 value will be like this 1101101010011010
- Assembly Language : this language is easier to write than machine language.
 - Actually the computer does not understand the assembly language, so that we will need to install Assembler to translate it
 - E.g. :

ADDF3 R1, R2, R3





Computer Languages

Machine Language - Assembly Language - High Level Language

- High Level Language : the easiest way for human to code, since this language is close to human language
 - E.g. : java, C++, C, C#, Python, etc

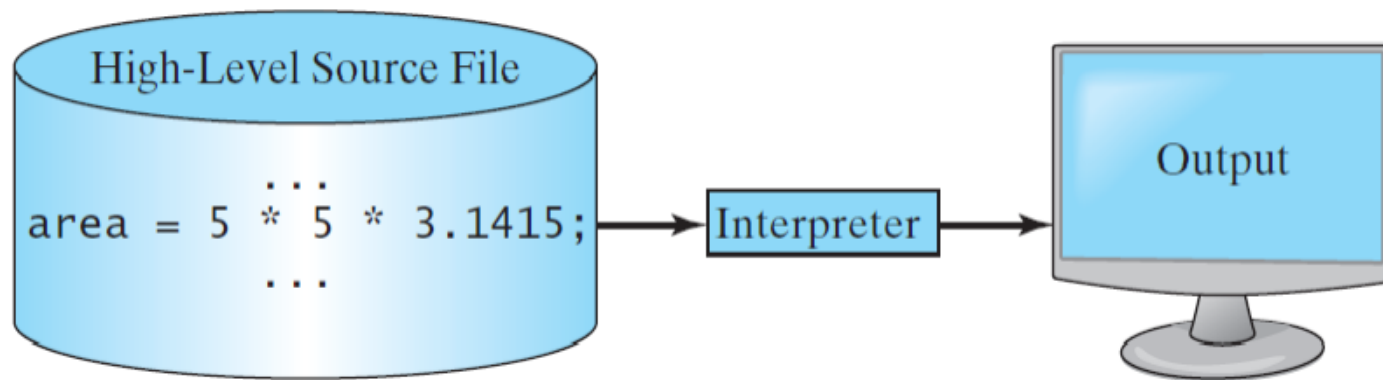
```
1 public class MyFirstJava{  
2  
3     public static void main(String[] args){  
4  
5         System.out.println("Hello Word");  
6  
7     }  
8 }
```

Interpreting/Compiling Source Code

- Software/program written in high-level languages are called **source code** or source programs.
- Because the computer actually does not understand the source code language, it must be **translated** into **machine language** so that it can be executed by a computer.
- Translation of source code into machine language can be done using other programming tools called **interpreters** or **compilers**.

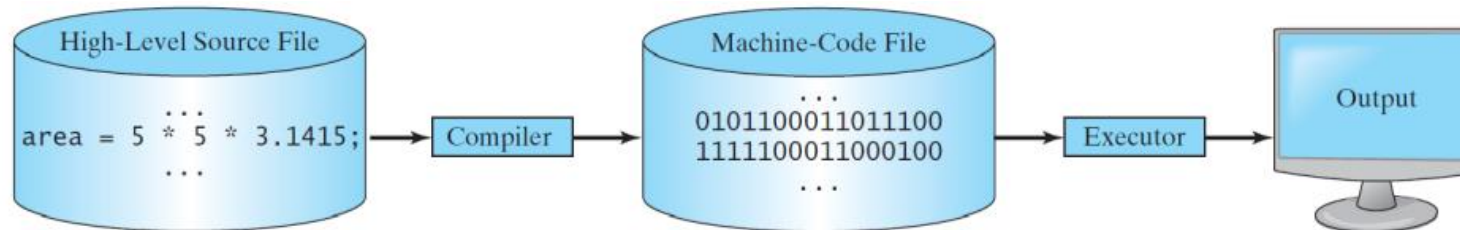
Interpreting Source Code

- The interpreter reads a statement from the source code then translates it into machine language and then executes it **immediately**. No need to save the interpreted code into a file



Compiling Source Code

- The compiler translates the entire source code into an **output file** containing machine language and then the file containing the machine language will be executed. It means that the compiled source code will be saved into a file first



Algorithm

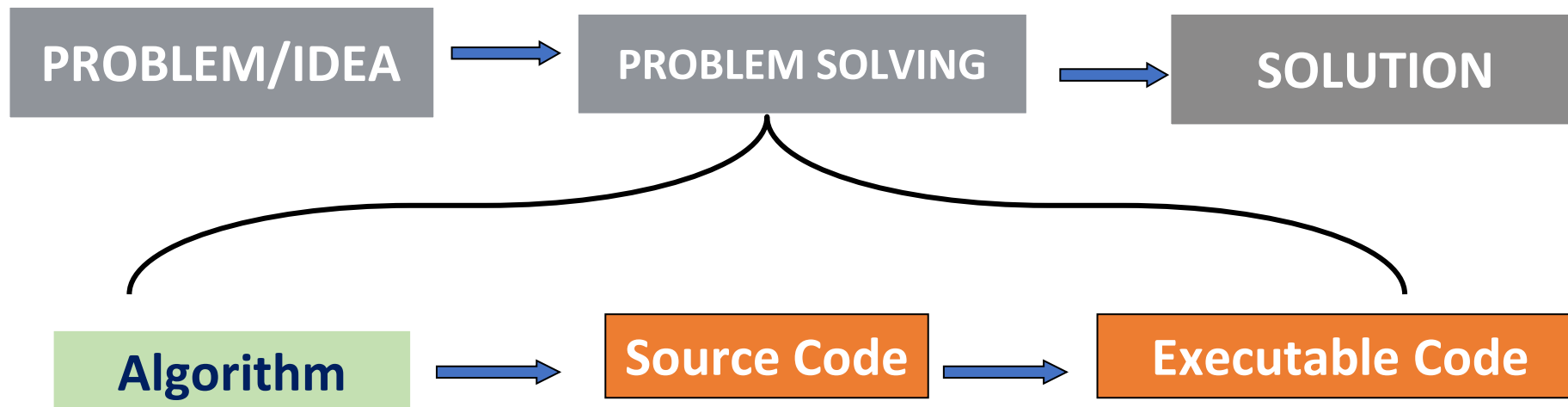
Basic of Algorithm (1)

- The data processing requires an **algorithm**
- Algorithm: a sequence of logical steps to solve the problems that are arranged **systematically** and **logically**
- Systematic: the sequence of steps that are arranged must be clear, have a certain pattern, could not be interchangably
- Logical: makes sense, can be read and accepted by reason
- The algorithm can be judged right or wrong, true or false

Basic of Algorithm (2)

- **Computer Programming**

- Algorithms implemented in computer programs
- A set of instructions or steps that a computer executes to solve a problem.



Algorithm Evaluation

- The result must be correct, as expected
- How good is the result of the algorithm
- Algorithm efficiency → time and memory

It is possible to create different algorithms from the same problem. As long as that algorithms produce the correct result, as expected, then all of them could be considered correct. But from them, we can actually evaluate the algorithm that is more efficient

Structure of Basic Algorithm

1. Sequential structure:

Used for programs whose statements are sequential.

2. Selection structure

Used for programs that use condition selection.

3. Loop structure

Used for programs whose statements will be executed repeatedly..

Algorithm Criteria

- Input
 - The data that will be processed by the algorithm, it could be no, one or more input
- Output
 - The result of the algorithm, at least at will be one result.
- *Definiteness*
 - Any instructions given should be clear and unambiguous..
- *Finiteness*
 - If the instruction set of the algorithm is traced, then the algorithm steps will end after a finite number of steps.
- *Effectiveness*
 - Each instruction should be basic enough so that it is easy to carry out as needed

Example

Problems : ironing some pieces of clothes

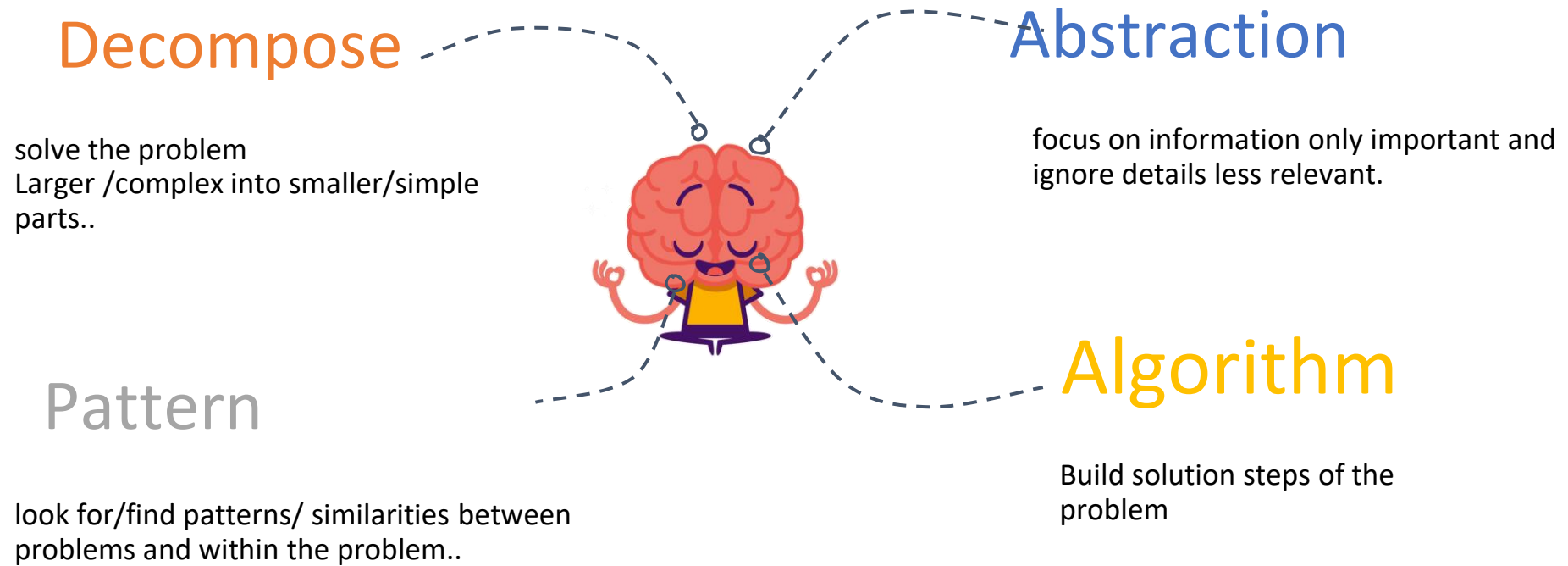
- Input : clothes
- Output : ironed clothes
- Other data : iron, ironing board
- Steps
 - Prepare the iron and the ironing board
 - Connect the power cable to the electricity
 - When the iron is ready start ironing
 - fold the ironed clothes
 - Repeat the ironing steps until all the clothes are ironed
 - Unplug the power cable

Computational Thinking

Computational Thinking ???

- Computational Thinking (CT) is a way of thinking to solve problems, design systems, understand human behavior.
- CT is the basic concept of informatics.
- CT means thinking about creating and using several levels of abstraction, starting to understand the problem so as to propose effective and efficient solutions.

4 Main Keys of CT



CT Example

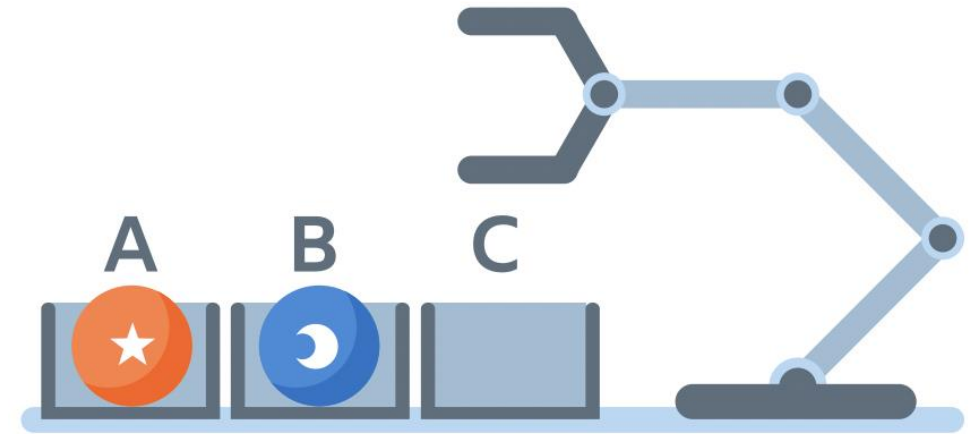
- The beaver wants to create a secret code to communicate. This code is generated by replacing each letter with a number according to the following table:

A	B	C	D	E	F	G	H	I	J	K	L	M
	2			5							12	13
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
		16						22				26

If the code generated by the beaver ninja is as follows, what message does the beaver want to convey?

Code	9	12,15,22,5	10,20,9
Message			

CT Example



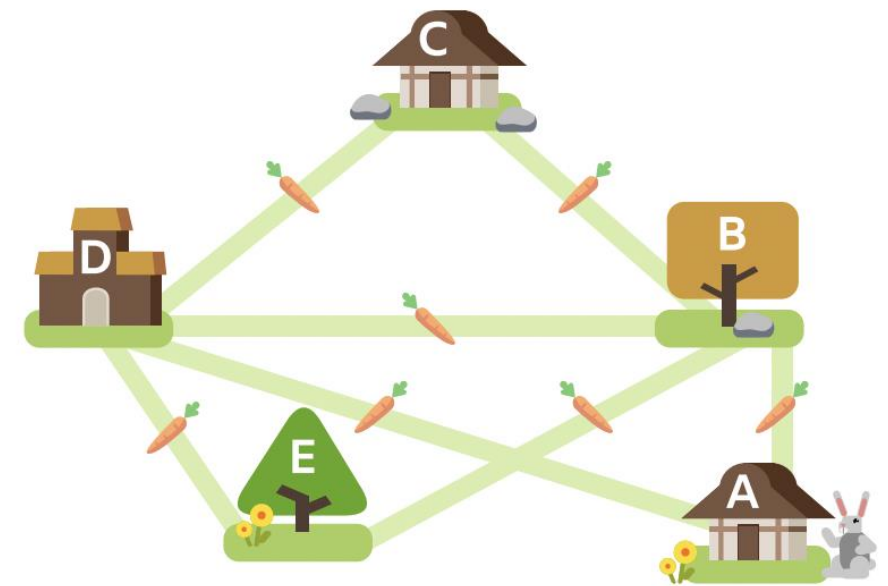
- Team Beaver builds a prototype robotic arm. The prototype would be tested in the following way: They placed the arm on a table with two balls: one in bin A, and one in bin B. Bin C was empty. The robotic arm follows an Algorithm with the following sequence of steps:
 1. Take the ball in tray A and place it in tray C
 2. Take the ball in tray B and place it in tray A.
 3. Take the ball in tray C and place it in tray B.

When the robot arm is finished, which of the following statements is true?

A. There are two balls in tray A	B. Nothing has changed. Each ball returns to its starting place
C. Tray A is empty	D. Tray C is empty

CT Example

The little rabbit's house is in **A**.
Starting from his house, he will pick carrots.
The carrots are shown in the picture beside.
The little bunny wants to take all the carrots
with the fastest speed and go back to her
home. Can you help the little bunny find the
optimal route?

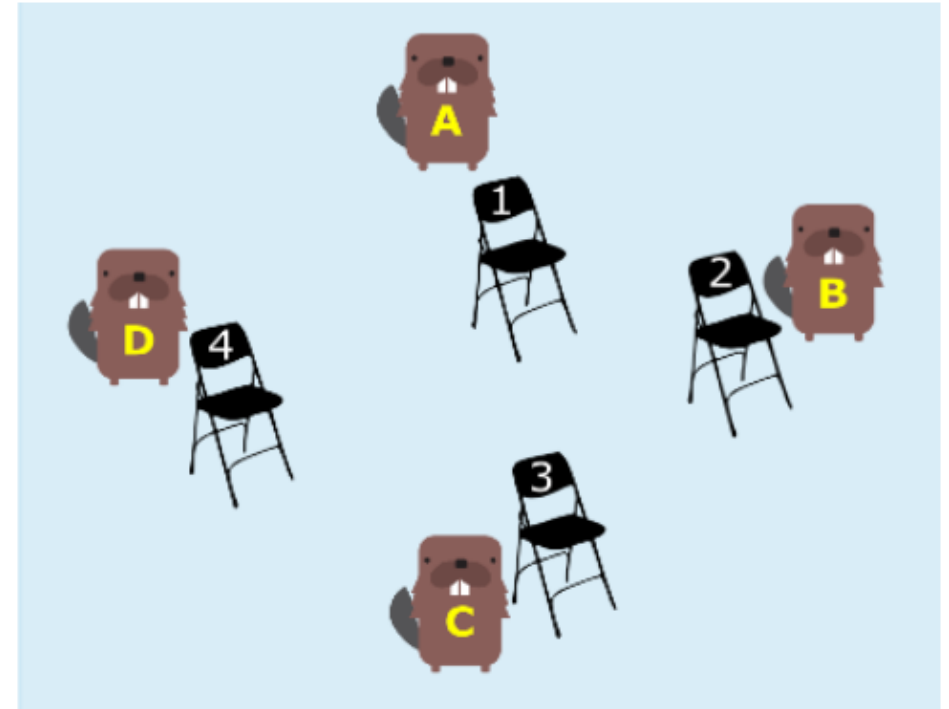


Which of the following Routes is the most optimal?

- A. ABCDEBDA
- B. ADEBADCB
- C. ABDABCDEBA
- D. ADEBCDABA

CT Example

- A group of 4 beaver plays "seat-music" i.e. switches seats while the music is playing.
- When the music starts, each otter must move to a chair in a clockwise direction. One seat can be occupied by more than one beaver.
- On each round, the Beaver (A) will move three (3) seats. The beaver (C) will move two (2) seats, while the beaver (B, D) will only move one (1) seat. All beavers move clockwise.



If at the start each position is as shown in the picture above, which seats are vacant in the 3rd round?

A. 1

A. 2

A. 3

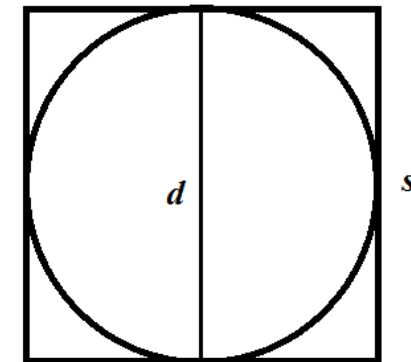
A. 4

Algorithm - Sequence

Pak Ahmad has a square-shaped land with a side of 100m, in Mr. Ahmad's land there is a circular flower garden. How much area of Mr. Ahmad's land is not planted with flowers? Create the Algorithm

Answer :

- **Input** : Side of Land = 100m
- **Output** : area of land not planted with flowers
- **Steps** :
 - Area of all land
 - = side x side = 10.000 m
 - Area planted with flowers (circles)
 - = $\pi * r * r = 3.14 * 50 * 50 = 7850$ m
 - Area not planted with flowers = area of the square – area of the circle
 $10.000 - 7850 = 2.150$ m



Algorithm - Sequence

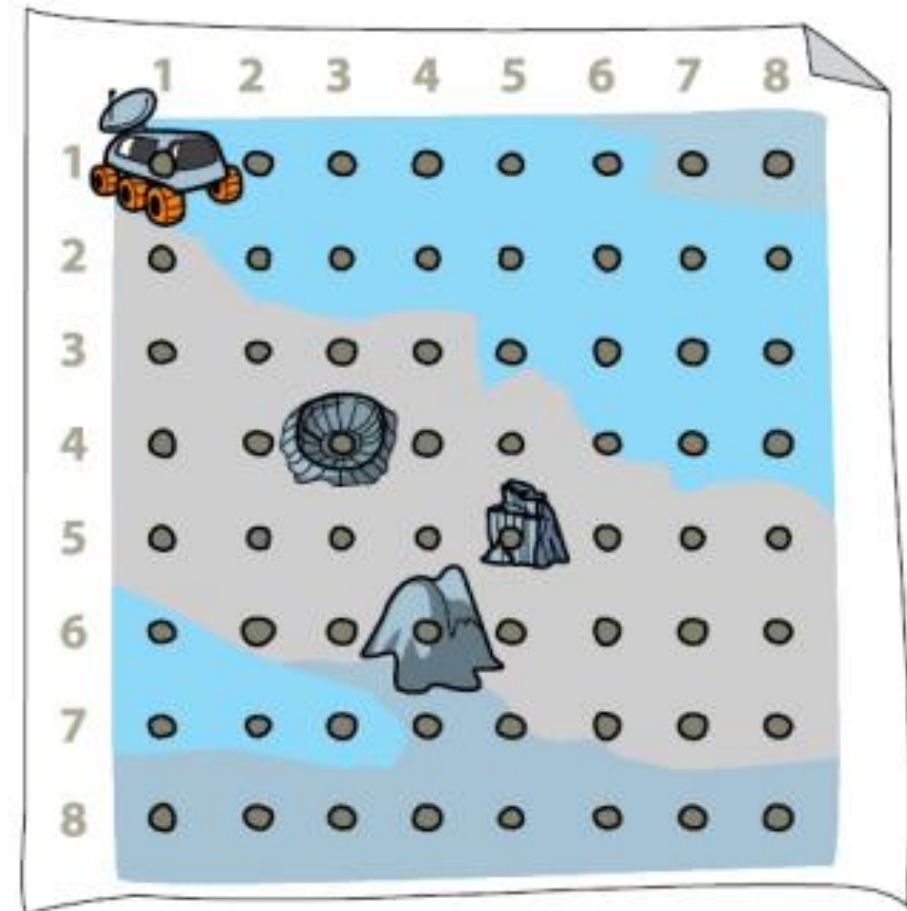
During the final exam there is a provision that if a student has a score below 70 then the student must re-take the exam. It turned out that Andi got a grade of 90. Must Andi do the re-take?? Create the algorithm

Answer :

- Input : Student's grade
- Output : retake or not
- Steps :
 - Enter the student's grade
 - If a student's grade is < 70 , then the student must re-take the exam
 - If a student's grade is > 70 , then the student does not need to take
 - Output the result
- Other data: -

Algorithm - Loop

- The beaver-controlled lunar rover moves from one direction to another using the map below. from (1,1) to (8,8). The first number is the row, the second is the column. Where are the craters, rocks and mountains located? Create the Algorithm:



Algorithm - Loop

- Input : Map (row, column), number of rows, number of columns
- Output : Mount Position
- Steps :
 1. Check repeatedly starting from the first row, from the 1st to the 8th column
 - If found object save row and column position information
 2. Check repeatedly from the second row, from the 1st to the 8th column
 - If found object save row and column position information
 3. Check repeatedly from the third row, from the 1st to the 8th column
 - If found object save row and column position information
 4. Check repeatedly from the fourth row, from the 1st to the 8th column
 - If found object save row and column position information
 5. Repeat until row 8

Any Question



???

Tasks

#1

- Based on the figure below, how many r's are there? Make the algorithm!

	0	1	2	3
0	r	R	B	r
1	a	r	R	z
2	M	R	r	R
3	R	O	t	r

#2

- Create an Algorithm to convert Number Grade to Letter Grade as shown in the following table

Nilai Angka	Nilai Mutu		
	Nilai Huruf	Nilai Setara	Kualifikasi
$80 < N \leq 100$	A	4	Sangat Baik
$73 < N \leq 80$	B+	3,5	Lebih dari Baik
$65 < N \leq 73$	B	3	Baik
$60 < N \leq 65$	C+	2,5	Lebih dari Cukup
$50 < N \leq 60$	C	2	Cukup
$39 < N \leq 50$	D	1	Kurang
$N \leq 39$	E	0	Gagal