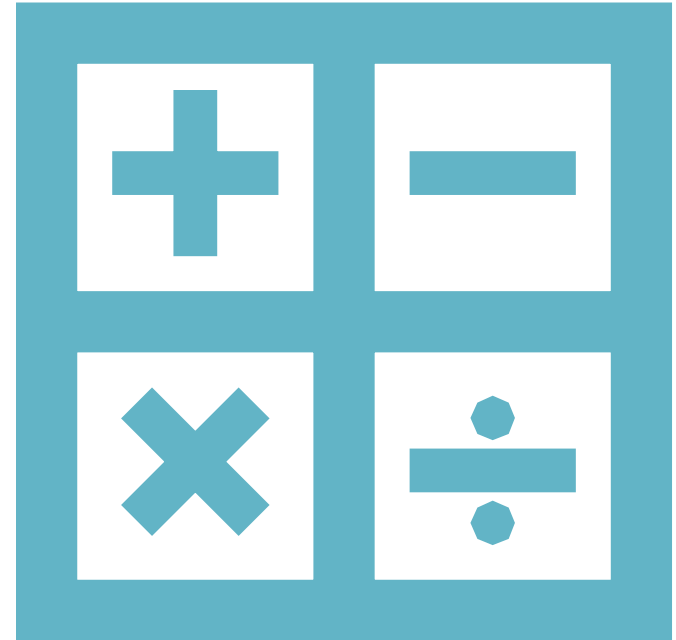


# MATHEMATICS FOR COMPUTING

WEEK 2



# ALGORITHMS

# ALGORITHMS

A set of instructions/ steps to perform a given task, or to solve a problem

- Recipes to cook
- Directions on Google Maps
- Techniques to add numbers
- And more!





## BRAIN FOOD

a) What is the algorithm to compute a truth table?

b) What are the algorithms to add all the natural numbers from 1 to 10?

# ALGORITHMS: EFFICIENCY

Is it enough that the algorithm is correct?

Always try to find the most optimal algorithm

What is the most efficient way to find the sum of natural numbers from 1 to 10?



# RECURSION

Always try to find patterns

Consider previously encountered familiar scenarios/ problems

Look for possible repetitions where you can repeat the same operation/ technique





## BRAIN FOOD

a) How do we compute the sum of all natural numbers from 1 to 100?

b) What's more efficient? CTRL+C, CTRL+V or typing when copying the word "text"?

# REASONING



# TYPICAL SIMPLE REASONING

- Consider the following Knowledge Base (KB)
  - File 'X' is either a binary file **or** a text file.
  - **If** file 'X' is a binary file **then** program 'P' does **not** accept it.
  - **If** file 'X' is a text file **then** program 'P' accepts it.
  - Program 'P' accepts file 'X'.
- *What can we conclude from these?*
- *Can we conclude the type of File X?*

# LOGICAL CONSEQUENCE FROM A KNOWLEDGE BASE

- Find all primitive propositions
  - File 'X' is a binary file -  $p$
  - File 'X' is a text file -  $q$
  - Program 'P' accepts file 'X' -  $r$
- Formalise the knowledge base

# VALIDITY

In Logic, a formula  $A$  is called **VALID** if its output value in the truth table is always **T** (true).

$$p \vee \neg p$$
$$\neg(p \wedge \neg p)$$
$$(p \wedge q) \Rightarrow p$$

## BRAIN FOOD

Compute the truth tables for the given formula

*A tautology is a proposition that is always true*

# HOW DO WE REASON?

What are the rules to be applied when we reason?

What can you conclude from:

- $A$  and  $A \Rightarrow B$
- $\neg A$  and  $A \Rightarrow B$
- $A$  and  $A \vee B$
- $\neg A$  and  $A \vee B$

answer  $B$

answer no conclusion

answer no conclusion

answer  $B$

# REASONING AND LOGICAL CONSEQUENCE

## *Definition*

**B** is a logical consequence of a knowledge base  $A_1, A_2, A_3, \dots, A_n$  if the following formula is valid:

$$(A_1 \wedge (A_2 \wedge (A_3 \wedge \dots A_n))) \Rightarrow B$$

Knowledge Base:  $p \Rightarrow q, q$   
Conclusion:  $q$

- File 'X' is either a binary file **or** a text file.
- **If** file 'X' is a binary file **then** program 'P' does **not** accept it.
- **If** file 'X' is a text file **then** program 'P' accepts it.
- Program 'P' accepts file 'X'.

## BRAIN FOOD

a) Form the truth table

b) Given the KB for previous example, conclude that File X is a text file

$KB = \{p \Rightarrow q, q\}; A = p$

$KB = \{p \Rightarrow q, p\}; A = q$

$KB = \{p \Rightarrow q, \sim q\}; A = \sim p$

$KB = \{p \Rightarrow q, \sim p\}; A = \sim q$

## BRAIN FOOD

Formulate the truth tables for the given knowledge base and consequence. State which is valid.



# QUESTIONS?

EMAIL: [SAPNA.K@IIT.AC.LK](mailto:SAPNA.K@IIT.AC.LK)