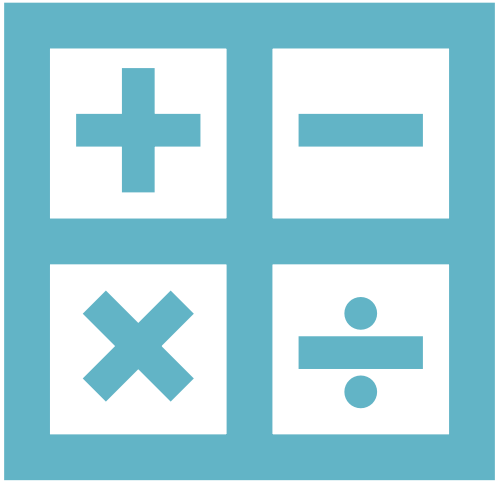
MATHEMATICS FOR COMPUTING



WEEK 01

KNOW YOUR MODULE TEAM

- Module Leader
  - Ms. Sapna Kumarapathirage – sapna.k@iit.ac.lk/ Oracle Room, 1st Floor
- Module Team
  - Ms. Ganesha Thondilege – ganesha.t@iit.ac.lk/ 501, 5th Floor
  - Mr. Dilan Shaminda – dilan.s@iit.ac.lk/ 3rd Floor, 302
  - Ms. Sachini Bambaranda – sachini.b@iit.ac.lk/ Oracle Room, 1st Floor
  - Ms. Nipuni Perera – nipuni.p@iit.ac.lk/ Oracle Room, 1st Floor

GROUND RULES

Take notes during lecture

Ask questions

Answer questions

Don’t disturb others

Don’t be late to lectures

MODULE DELIVERY

12 weeks of lectures and tutorials in the semester

You will have a 2-hour lecture and a 2-hour tutorial each week

Tutorials will follow topics covered in the previous lecture

AT THE END OF THE MODULE YOU WILL BE ABLE TO..

01

Analyze and produce answers to various scenarios using Reasoning Techniques, Probability and Statistics, Set Theory, Matrices, and Vectors

02

Identify problem solving strategies

03

Have an introductory knowledge about Graphs and Trees

WHAT'S UP AHEAD

Booleans, Reasoning with booleans, Logic

Graphs and Trees

Probability

Sets, Relations and Functions

Statistics

WHAT'S UP AHEAD

Matrices

Vectors

Proof

Problem Solving based on Propositional Logic

MODULE MARKS

You will have TWO in-class tests

Both ICT's will be carried out online through Blackboard

Each ICT will weigh 50% to the final module mark

If module mark >= 40; then you will pass the module

ICT's will be based on the work done in lectures and tutorials

WHY LEARN MATHS?

Any information system, software, website, or even games will have inputs, outputs, and processes

A large part of study of information systems, programming and computer science is the process of PROBLEM SOLVING

We need techniques to tackle them. And in many cases we need some knowledge of fundamentals – MATH!

QUESTIONS?


Expedia
DOTA 2
FORTNITE
tinder
amazon
ebay
Booking.com

LOGIC

BOOLEANS

- Booleans (IF …THEN, AND, OR, NOT) are necessary to understand how to reason out and to make rules about how a system should function
- BOOLEAN expressions are related to mathematical concepts.
- Most high-level computer languages use Boolean expressions to construct complex algorithms and complex program instructions

PROPOSITIONS

A Boolean variable, *p*, is a symbol that takes a Boolean value

either p is *True*, or p is *False*

PROPOSITIONS

Proposition is a declarative sentence that is either True or False but not both

Example

All the following declarative sentences are propositions.

1. *Colombo, is the capital of Sri Lanka.*
2. $1 + 1 = 2$
3. $2 + 2 = 3.$

Propositions 1 and 2 are **true**, *whereas 3 is* **false**

PROPOSITIONAL VARIABLES

- Variables that represent propositions are called Propositional Variables
- We use letters to denote propositional variables, like we do with numerical variables
- The truth value of a proposition is denoted by T (true) or F (false)

COMPOUND PROPOSITIONS

Many mathematical statements are built using more than one proposition. When we use logical operators to combine two or more propositions, they are called compound propositions.

LOGICAL OPERATORS

¬ ~	∧ &	∨	⟶ ⇒
NOT Negation	AND Conjunction	OR Disjunction	IF …..THEN Implication

Let's consider a propositional language where

- p *means* "Paola is happy",
- q *means* "Paola paints a picture",
- r *means* "Renzo is happy".

Formalize the following sentences:

BRAIN FOOD

a) "if Paola is happy, then she paints a picture"

b) "Paola and Renzo are happy"

c) "Renzo is happy but Paola isn't happy"

d) "if Paola is happy and paints a picture then Renzo isn't happy"

TRUTH TABLES

CONSTRUCTING TRUTH TABLES

- Each proposition is either true or false
- Compound propositions are constructed from simpler ones
- If the number of atomic propositions = m; then the

$$\text{rows in the truth table} = 2^m$$

- The rows of the truth table represents all the possible combinations of the truth values that the atomic propositions can take

( ) » ~ » ∧ » ∨ » →

NEGATION

It is not the case that…

Negation is so called UNARY operation as it only applies to one proposition

P	~P
T	F
F	T

CONJUNCTION

The conjunction of a Boolean expression P with a second Boolean expression Q is True when both P and Q are True and is False otherwise.

P	Q	P ∧ Q
T	T	T
T	F	F
F	T	F
F	F	F

DISJUNCTION

The disjunction of a Boolean expression P with a second Boolean expression Q is False when both P and Q are False and is True otherwise

P	Q	P v Q
T	T	T
T	F	T
F	T	T
F	F	F

IMPLICATION

$P \rightarrow Q$ is meant to reflect the conditional statement "if P then Q" in ordinary language

P	Q	$P \rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

EXAMPLE

- Consider the following proposition

  If X is divisible by 4 then X is divisible by 2

- What are the atomic propositions?
- What is the logical formula for this?
- How many rows should be there in the table?
- What are the columns?
- Computing the truth table?

- $(p \to p) \to p$
- $p \to (p \to p)$
- $p \vee q \to p \wedge q$
- $p \vee (q \wedge r) \to (p \wedge r) \vee q$
- $p \to (q \to p)$

BRAIN FOOD

a) How many rows should be there in the table?

b) How many columns should be there in the table?

c) Using the answers in a) and b) compute the truth tables for the given compound propositions

QUESTIONS?

EMAIL: SAPNA.K@IIT.AC.LK