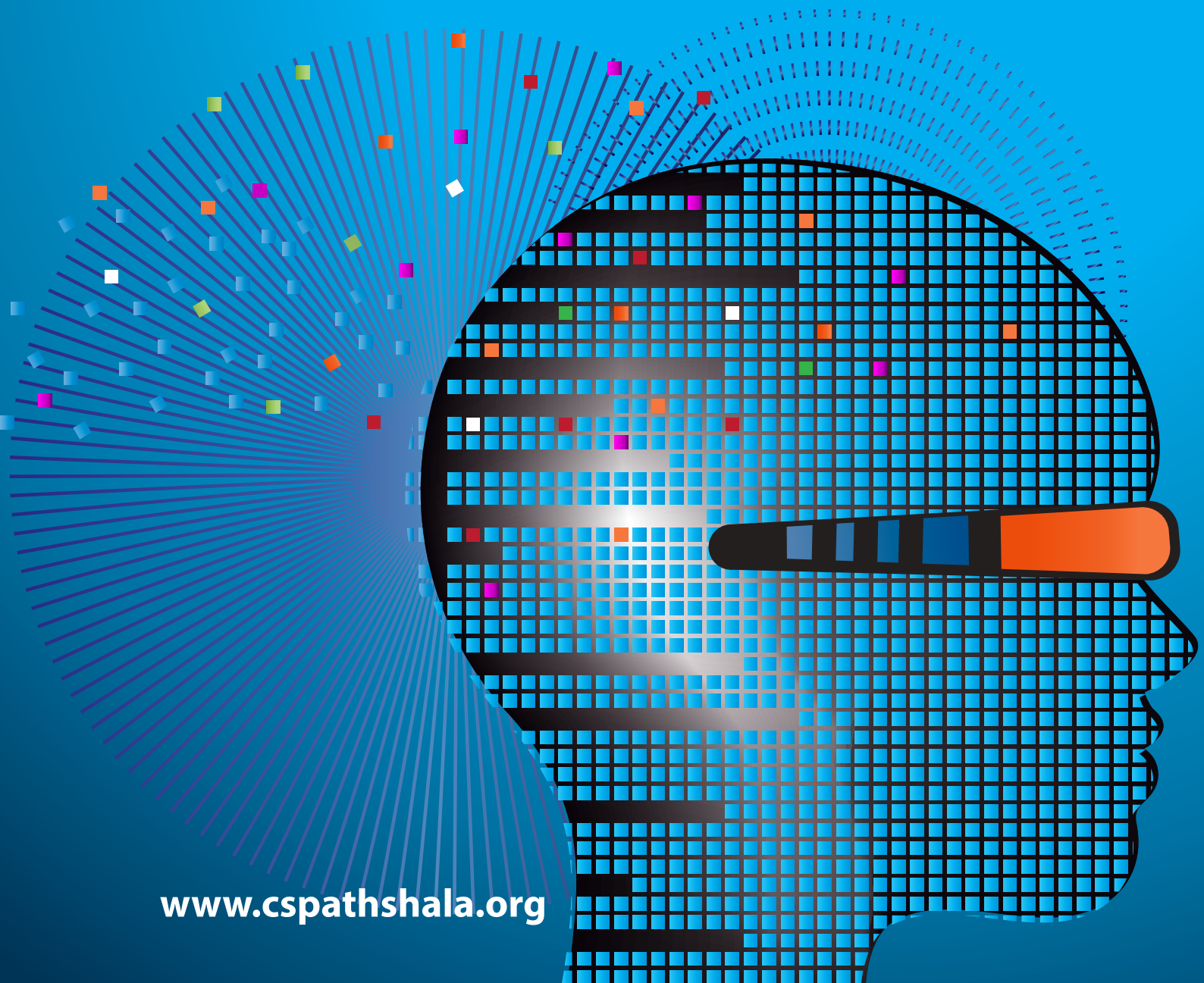


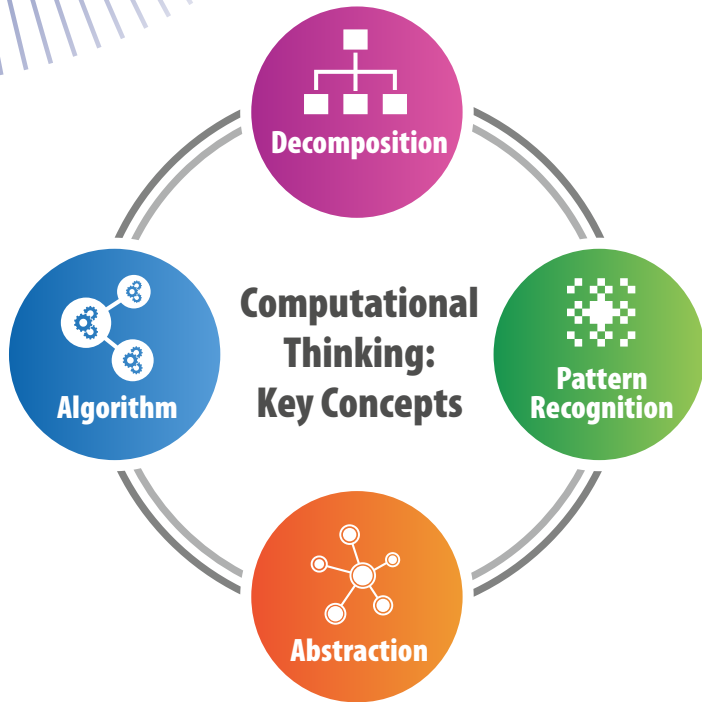


**CS** pathshala™

# Bringing Computational Thinking to Schools



[www.cspathshala.org](http://www.cspathshala.org)



We are entering the digital age and people from every walk of life will need to be familiar with computing in some form or the other. This will give rise to a huge demand for computing skills leading to a talent shortage unless computing is introduced in schools right now. To address the skills demand created by the industrial revolution, the Sciences and Mathematics were included in the school curriculum in the early 19th century. Now as we participate in the digital revolution, we need to train our children on skills for the digital age.

However there is a widespread lack of knowledge of what constitutes the core of computing: is it just the use of word processors and spreadsheets or are there more fundamental principles that underlie this science. Computational thinking that includes

problem solving, algorithmic thinking and critical reasoning is core to computer science. All children will need to be trained on these skills as foundational skills. Computational thinking can equip our children to become creators and inventors and also socially responsible citizen.

CSPATHSHALA ([www.cspathshala.org](http://www.cspathshala.org)) is an Association for Computing Machinery (ACM) India education initiative to bring a modern computing curriculum to Indian schools.

Thanks for all your support. Kids are enjoying the classes.

*Mrs. Madhulika Bhupatkar*  
Principal, Gurukul

This session was one of the best sessions cause kids came out with very good examples of algorithm in day to day life. Could do with some more examples to explain to students.

*Mrs. Bhalwankar*  
Millennium National School

We are giving some home work also. e.g. write an algorithm to pack your bag. Write an algorithm to finish the home work etc. Concept of loop was given. Students response to it was extremely good. They gave beautiful examples from day to day life.

*Mrs. Athale, Vikhe Patil School*



## Vision, Mission, Goals

- Our vision is to prepare our students to participate creatively in the digital age.
- Our mission is to teach computing as science to every child in every school in India by 2030!
- Our goals are to shape a modern computing curriculum, develop detailed content and finally train teachers.



## Strategy

- **Awareness:** Create awareness on why computer science (CS) should be taught in schools and how is it different from ICT.
- **Curriculum:** Shape a modern and robust CS curriculum and develop detailed teaching aids to be provided for free to teachers.
- **Training:** Train teachers through a scalable teacher development and training program. Empower teachers through teacher communities enabling sharing of ideas and resources.



## Accomplishments

- **Committees:** National advisory and curriculum committees comprising academicians, industry experts and computing teachers
- **Workshops & training programs:** CSpaathshala has conducted 20 workshops and training programs reaching 600+ teachers
- **Teaching aids:** Developing content for 40 lessons/grade for grades 1-8. Delivered content for 20 lessons/grade for grades 1-5
- **Pilot:** 15 schools with 35 teachers and 5000 students are part of the pilot program in Pune. 60 schools from Chennai, Kochi, Pune have already signed up for 2017-18 pilot.
- **Volunteers:** 140+ volunteers and growing



## 3 Year Plan (2016-2019)

- From 15 schools in 2016-17, enlist 60-70 schools in the 2nd year and 216 schools from select cities in the 3rd year into a pilot program. Full scale deployment will commence in the 4th year.
- Teacher training through a Master teacher training program in 2017
- Government and Rural schools to be included in the 2017-18. Vernacular language to be piloted in the 2nd year.
- Setup platform to support teacher communities

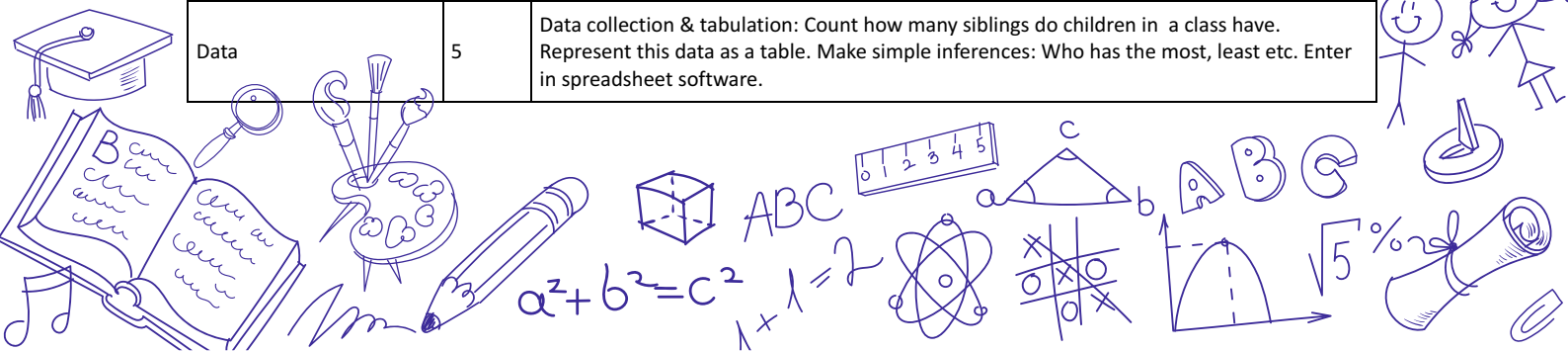
# Curriculum 2017-18

## Standard I

Area	Lessons	Topic
Digital Literacy	15	Parts of computers, Keyboard, Paint tools, GCompris: Memory, Maze, Color and other activities. Introduction to networks.
Problem Solving & Discrete Maths	10	Systematic Listing, Counting, Reasoning: Counting methodically so that each object is counted and no object is counted twice.  Discrete Mathematical Modeling: Introduction to maps. Games/activities using maps like avoiding certain paths that are blocked.  Iterative Patterns and Processes: Simple patterns in daily life occurring again and again. Visual patterns like Rangoli  Information Processing: Objects and their attributes like shape, size, color, use etc.  Devising Algorithms: Following simple instructions to perform a task
Programming	5	Following simple instructions like stand up, sit down etc., ordering & sequencing of instructions like get-up - brush-you-teeth - take-bath -get-ready-for-school.
Algorithms	5	Sequence of instructions: Algorithms in daily life ( daily routine, making cake), path in a grid to fetch a fruit.
Data	5	Data collection & tabulation: Count how many siblings do children in a class have. Represent this data as a table. Make simple inferences: Who has the most, least etc

## Standard II

Area	Lessons	Topic
Digital Literacy	15	Parts of computers, Keyboard, Paint tools, Word processing, File systems, communication & reliability, Introduction to networks.
Problem Solving & Discrete Maths	10	Systematic Listing, Counting, Reasoning: Counting objects, without touching. Activities related to sequence of numbers; counting combinations; finding numbers that have been hidden  Discrete Mathematical Modeling: Discrete objects; shapes. Explore simple maps from real-life.  Iterative Patterns and Processes: Repeating patterns. Draw patterns on paper/floor: Making Rangoli: on paper, on the floor.  Information Processing: Classification of objects on simple attributes like big/small; red/green/white colors; objects to be used in a kitchen/in a classroom, etc. Storing classified information in a table.  Devising Algorithms: Solving simple problems to introduce "better" ways to doing tasks. Like determining the shortest path from one site to another on a map laid out on the classroom floor
Programming	5	Sequence and combination of instructions to perform task. Activities.
Algorithms	5	Sequence of instructions: Algorithms in daily life ( daily routine, making cake, rasam), path in a grid to fetch a fruit.
Data	5	Data collection & tabulation: Count how many siblings do children in a class have. Represent this data as a table. Make simple inferences: Who has the most, least etc. Enter in spreadsheet software.



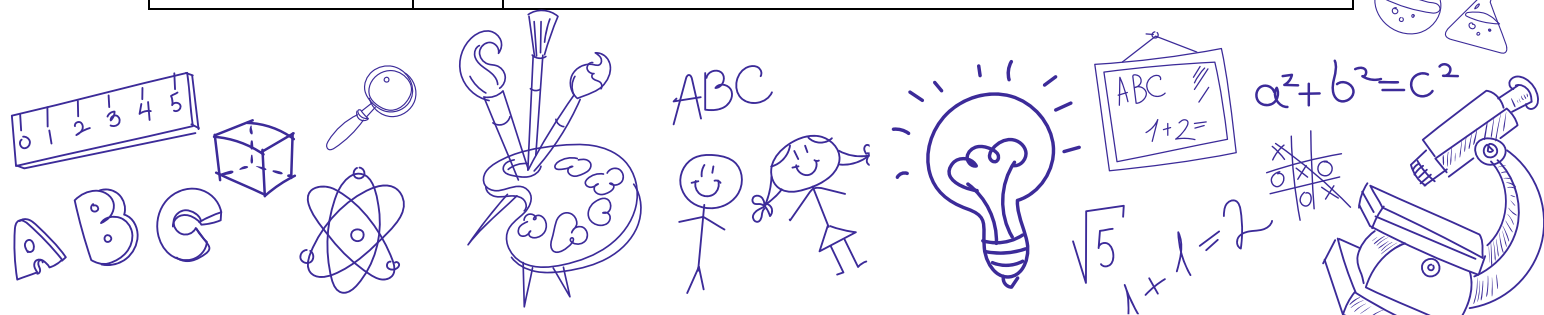
# Curriculum 2017-18

## Standard III

Area	Lessons	Topic
Digital Literacy	5	Parts of computers, Spreadsheets: Arrange data, tabulate, formulas, Introduction to networks
Problem Solving & Discrete Maths	10	<p>Systematic Listing, Counting, Reasoning: Counting combinations: pairs of numbers, how do you know if all pairs are accounted?</p> <p>Discrete Mathematical Modeling: Doing things to scale in a map. Solve puzzles like Wolf-Sheep-Grass Puzzles (at most two can cross the river), The three cups problem using graphs</p> <p>Iterative Patterns and Processes: Patterns in numbers: Counting. Pattern in words: rhyming, spelling</p> <p>Information Processing: Simple ways of arranging and analyzing information: tabulating names, subject, marks for students; storing information: pictures, documents, tree-diagrams, maps, pictographs, etc.</p> <p>Devising Algorithms: Children learn to split bigger tasks into smaller, known tasks (e.g. multiplying two four-digit numbers)</p>
Programming	10	Sequence and combination of instructions to perform task. Conditionals. Basic Iterations. Introduction to Scratch.
Algorithms	7	Simple algorithms. Conditionals: Convert hours + minutes to minutes. Convert meters+centimeters to centimeters
Data	8	Data collection & tabulation: Collect names and phone numbers Enter in spreadsheet, sort names, run small manually timed experiments on how fast one can find a name with and without sorting.

## Standard IV

Area	Lessons	Topic
Digital Literacy	2	Networking
Problem Solving & Discrete Maths	10	<p>Systematic Listing, Counting, Reasoning: simple 4x4 Sudoku puzzles</p> <p>Discrete Mathematical Modeling: Relations, between people, things, games. Paths in graphs, cost of paths</p> <p>Iterative Patterns and Processes: Visual patterns, patterns in nature</p> <p>Information Processing: Simple data compression. Representing information and introducing codes</p> <p>Devising Algorithms: Robot game to follow simple instructions. Completeness of instructions.</p>
Programming	10	Using Scratch
Algorithms	10	Simple algorithms. Conditionals: Sorting 3-4 numbers, finding paths in grid with blocked cells
Data	8	Data visualization, Pattern spotting: Color countries or states based on population, literacy levels etc. Given a sequence of numbers spot periodicity patterns E.g., traffic is low on Saturdays and Sundays but high on other days



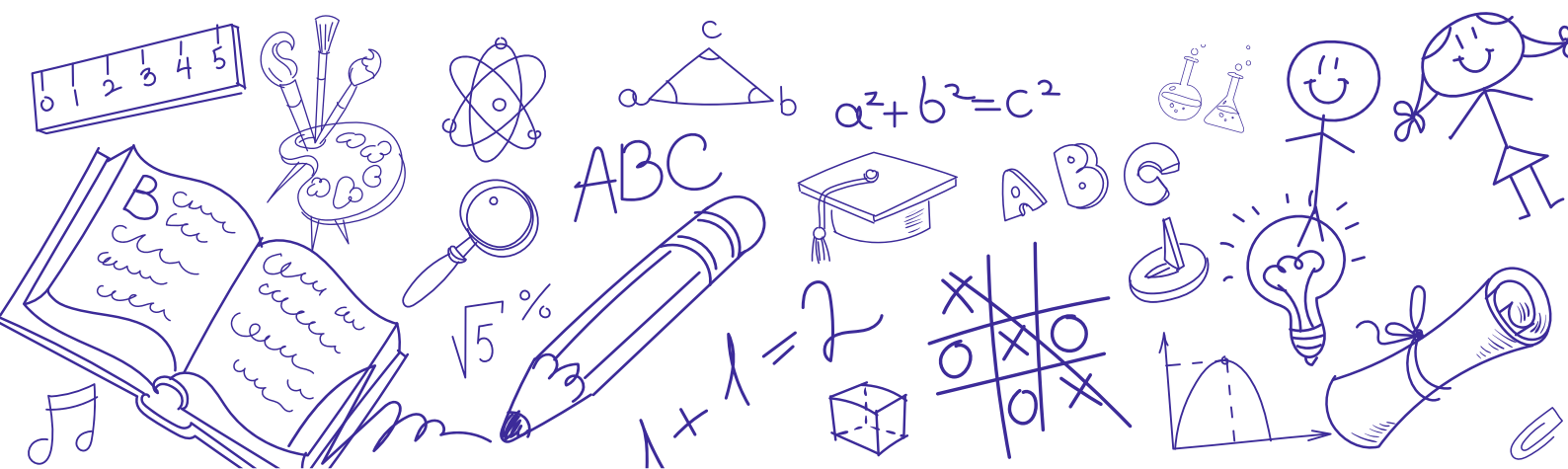
# Curriculum 2017-18

## Standard V

Area	Lessons	Topic
Problem Solving & Discrete Maths	10	Systematic Listing, Counting, Reasoning: count combinations under certain restrictions. Discrete Mathematical Modeling: cycles in a graph and trees (using examples like family tree). Seven Bridges of Koenigsberg puzzle Iterative Patterns and Processes: Symmetry in patterns: reflection, rotation, translation . Math activities using patterns Information Processing: Re-arranging and summarizing information Devising Algorithms: Notion of best/optimal solutions using examples
Programming	10	Scratch programming
Algorithms	10	Simple algorithms. Conditionals: Tower of Hanoi with 3 disks. Guessing a number with yes/no as answer. Adding 3 digit numbers
Data	10	Binary representation, Data transmission, Coding, Data Compression: Learn how alphabets are represented in binary. Use simple codes to send and receive data. Use simple compression methods to reduce data size

## Standard VI

Area	Lessons	Topic
Digital Literacy	2	Security
Problem Solving & Discrete Maths	10	Systematic Listing, Counting, Reasoning: counting word permutations and combinations. 9x9 Sudoku Discrete Mathematical Modeling: puzzles on graph related topics. graph planarity using games Iterative Patterns and Processes: Symmetry in patterns: Binary and algebraic expressions as trees Information Processing: Sorting on various parameters/ attributes. complex examples on representation and codes Devising Algorithms: Flowcharts
Programming	10	Scratch programming assignments
Algorithms	8	Types of algorithms: 20 Questions puzzle. Testing primality. Sorting 5 numbers
Data	10	Speech and Image Data Representation, Analysis of Speech and Image data: Represent a speech signal as a sequence of numbers and as a waveform.





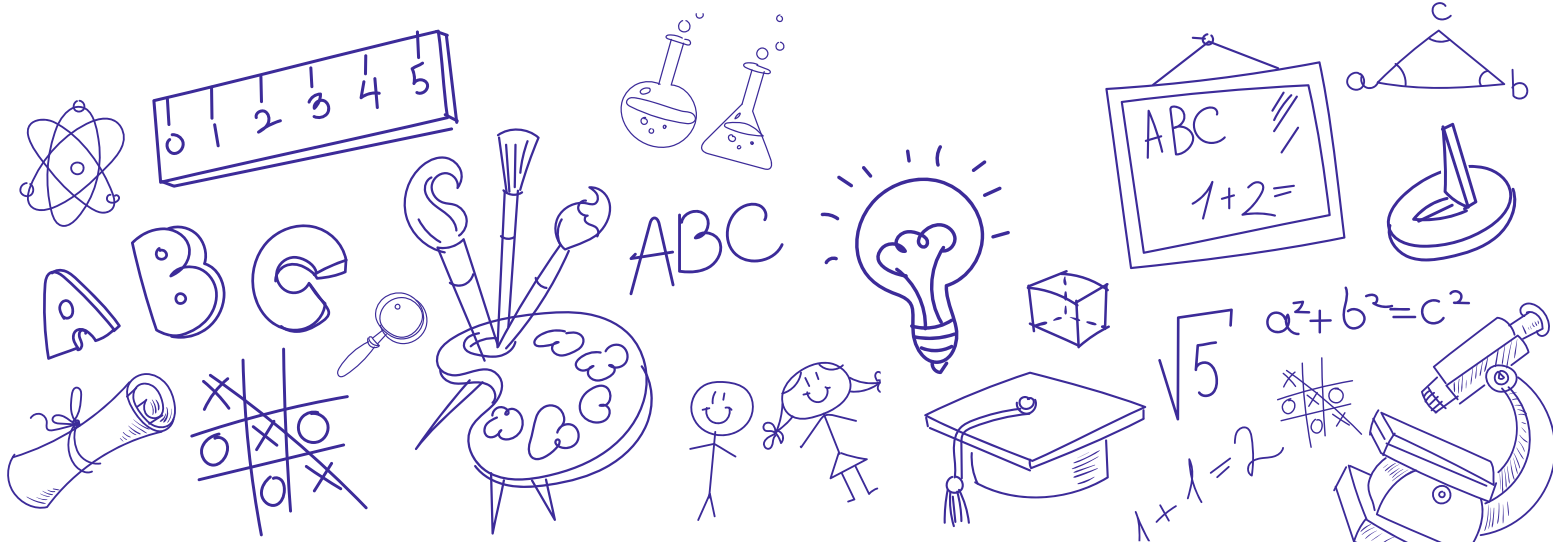
# Curriculum 2017-18

## Standard VII

Area	Lessons	Topic
Digital Literacy	2	Security
Problem Solving & Discrete Maths	10	Systematic Listing, Counting, Reasoning: permutations and combinations.  Discrete Mathematical Modeling: spanning trees and real-world problem solving using spanning trees  Iterative Patterns and Processes: Symmetry in patterns: repetitive process in tasks like sequential search. regular expressions  Information Processing: Data compression. Sorting exercises, Disordering and Derangement.  Devising Algorithms: Optimization strategies
Programming	10	Python Programming. Data structures. Sorting
Algorithms	8	Types of algorithms: $x^{10}$ using multiplication, sorting a deck of cards
Data	10	Data distributions, mean, variance, random sampling, text searching

## Standard VIII

Area	Lessons	Topic
Digital Literacy	2	Security
Problem Solving & Discrete Maths	10	Systematic Listing, Counting, Reasoning: basic probability.  Discrete Mathematical Modeling: graph coloring. Modeling the 5-room house puzzle as a graph coloring problem. Revisiting Wolf-Sheep-Grass puzzle as a graph problem.  Iterative Patterns and Processes: model a system and improve it in iterations  Information Processing: basic cryptography using simple activities and exercises  Devising Algorithms: Compare algorithms
Programming	10	Python Programming assignments arguing for efficiency
Algorithms	8	Types of algorithms: GCD algorithms, Customer/Waiter in a restaurant (parallel, synchrony)
Data	10	Means and variances, Random sampling, Hypothesis testing, Correlation





## Association for Computing Machinery (ACM)

The ACM ([www.acm.org](http://www.acm.org)) is the world's largest not-for-profit scientific and computing society. ACM brings together computing educators, researchers, and professionals to inspire dialogue, share resources, and address the field's challenges. ACM has endeavoured to tailor curriculum recommendations for undergraduate and school computing curriculum. ACM India ([india.acm.org](http://india.acm.org)) Education Council is involved in recommending an undergraduate computer science curriculum, conducting faculty development programs and CSPathshala – an initiative to teach computing in schools.



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