USA: Advanced Placement curriculum Computer Science Principles

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USA: AP Computer Science Principles (an Advanced Placements course)

AP: Advanced courses for High School students (==> credit 4 uni.)

Computational Thinking practices vs. main topics

P1: Connecting Computing

P2: Creating Computational Artifacts

P3: Abstracting

P4: Analyzing Problems and Artifacts

P5: Communicating

P6: Collaborating

Big Idea 1: Creativity

Big Idea 2: Abstraction

Big Idea 3: Data and Information

Big Idea 4: Algorithms

Big Idea 5: Programming

Big Idea 6: The Internet

Big Idea 7: Global Impact

USA: Many CSP curricula available

Curriculum	Course Delivery	Programming Language / Environment
CodeCombat	Web Based	JavaScript / Python / HTML
The Beauty and Joy of Computing	Web Based edX	Snap!
Mobile CSP	Web Based	App Inventor
UTeach CSP	Web Based	Scratch / Processing
PLTW CSP	Canvas LMS Printable Student Content	Scratch / App Inventor / Python / HTML
Code.org CSP	Web Based	App Lab / JavaScript (Blockly)
CS50 AP	Wikispaces	Scratch / C
CS Matters	Face to Face	Python
EarSketch	Web Based: make music	Python / JavaScript
CodeHS	Web Based	JavaScript

The BJC curriculum (Beauty and Joy of Computing)

https://bjc.edc.org

Unit 1: Introduction to Programming

Unit 2: Abstraction

Unit 3: Data Structures

Practice CREATE TASK

Unit 4: How the Internet Works

Unit 5: Algorithms and Simulations

CREATE TASK <== EXAM

Unit 6: How Computers Work

Unit 7: Fractals and Recursion

Unit 8: Recursive Functions

Unit 1: Introduction to Programming

5 Lab units (plus some optional)

Pair programming: Students work in pairs and swap role during the unit

Discussion of what to do as a way to enforce ANALYSIS before implementation

1) move a sprite randomly, greet, save the program

2) Gossiping Sprites: use functions to select a random message to "say", define functions, ask something

3) Polygons: draw, repeat, ask numbers

4) Protect Privacy ***(focus on social issues)***

5) Follow the mouse or another sprite

Optional projects: Pong, drawing, random sentences,

Unit 2: Abstraction

1) Variables: local (number guessing game) and global (score of the game), Import/Export blocks

2) Lists: shopping list app, quiz app

3) Making decisions: If-the-else, Predicates, Boolean expressions, list filters

4) Math library: making new math functions

5) Copyright and Fair Use *(focus on social issues)*

Optional: modelling language (plurals), mastermind, kaleidoscope, automated fortune teller

NOTICE: the suggested programming style is FUNCTIONAL

Unit 3: Data Structures

1) Complex drawings (cycles)

2) ADT: managing a contact list (name surname phone number …), by defining its builder and getters/setters

3) Tic-tac-toe: check for winning game, lists comparison, map

4) Robots and AI: introduction and implications to Society

5) Computers and work: new works, impact on work

Optional projects: drawings, animations, music

AP CREATE TASK (practice)

Kids practice how to organize the design and development of the "AP create task exam" with the help of teachers and peers

1) Using a Development Process to Organize Your Coding

2) Choosing Your Project

3) Implementing Your Development Process

4) Testing Your Project

5) Communicating About Your Project

6) Evaluating Your Work

During the exam they will have to work by themselves

Unit 4: How the Internet Works

1) Computer Networks: Network redundancy, internet addresses, history

2) Cybersecurity, cryptography: Caesar cypher project

3) Social networks, cyberbullying, censorship, search engines

4) Data representation and compression

Unit 5: Algorithms and Simulations

1) Search algorithms and efficiency

2) Models and simulations: distributions of flipping a coin, spread of a virus, bank queue

3) Analysing data:

4) Unsolvable and Undecidable problems, Paradoxes, the Halting problem

5) Computer and Wars: cyberwar, drones, autonomous weapons, ethics

6) Tic-Tac-Toe with a Computer Player

EXAM (CREATE TASK)

Unit 6: How Computers Work (optional)

1) Computer abstraction hierarchy

Application

Programming Languages

Libraries

Operative System

Hardware

Components

Integrated Circuits

Gates

Transistors

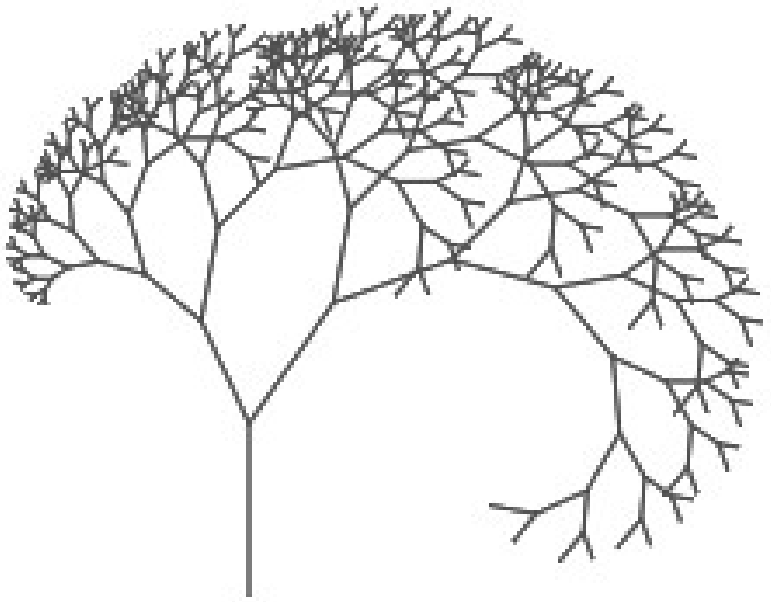
2) History and Impact of Computers

Unit 7: Fractals and Recursion (optional)

1) Trees in a Forest

Recursive case

Base case



2) Recursion Projects

Triangle Fractal

Koch Snowflake

Lévy C-Curve Fractal

Fractals in Nature

Recursive Mondrian

Unit 8: Recursive Functions (optional)

1) Recursive Reporters (functions)

2) Base conversion

3) Subsets

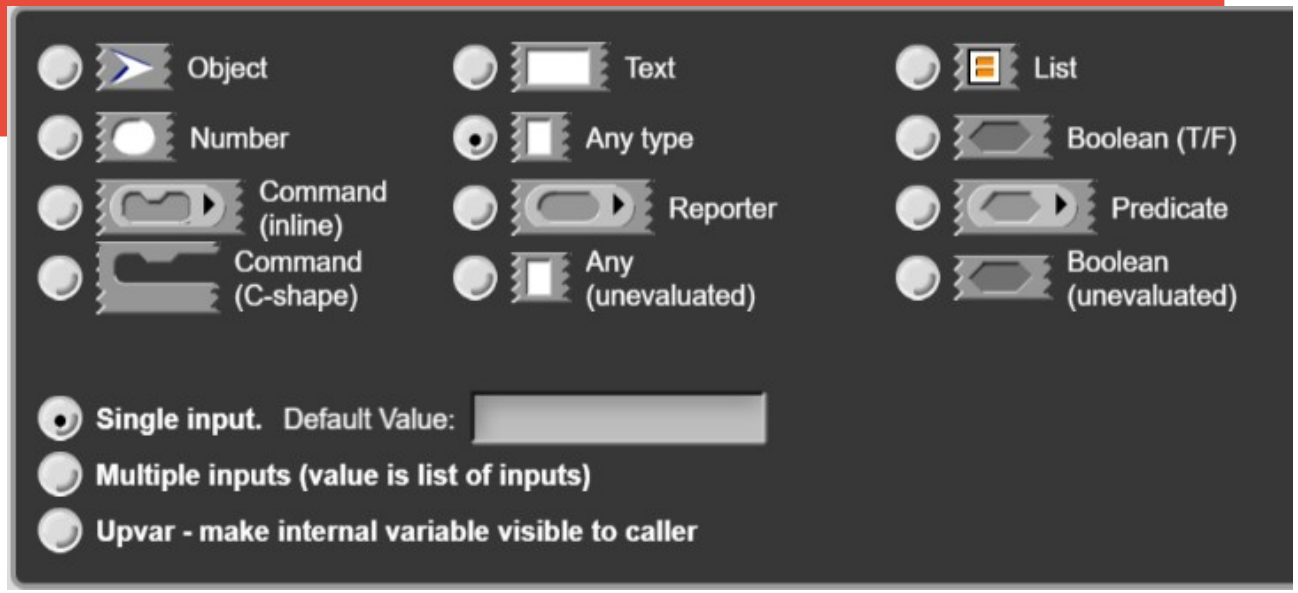
4) Higher Order Functions (on lists)

Optional Projects: Pascal/Tartaglia triangle, Sorting

Snap!

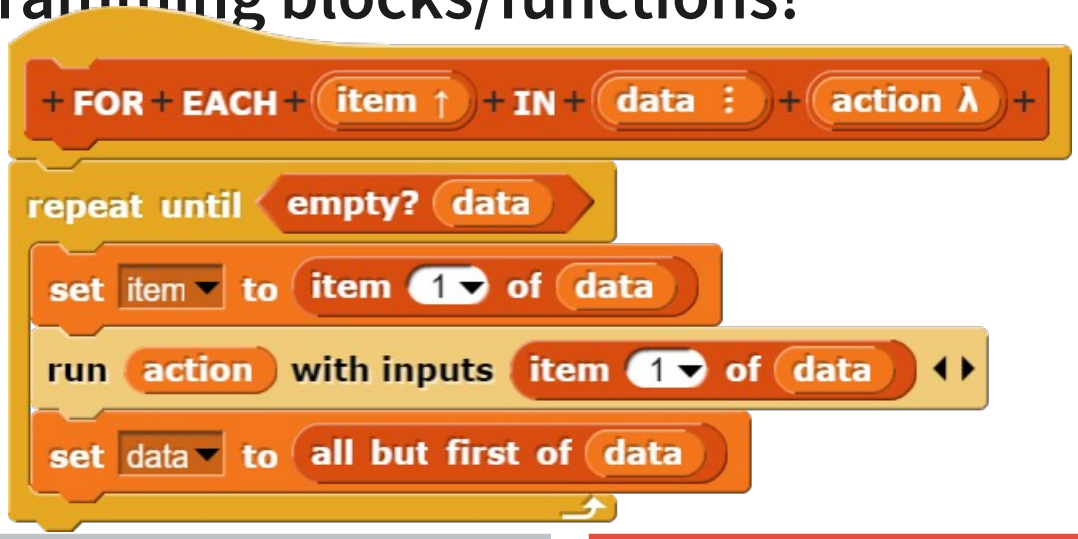
Other features

Code arguments!



Arguments by reference!

This allows building meta-programming blocks/functions!



Robot maze exploration example