
THE USE OF PYTHON IN PRACTICAL STUDENTS' WORK AT PROGRAMMING- RELATED COURSES

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Talk Outline

- Introduction & Motivation
- Algorithms Design
- Artificial Intelligence
- Conclusions

World of Programming Languages



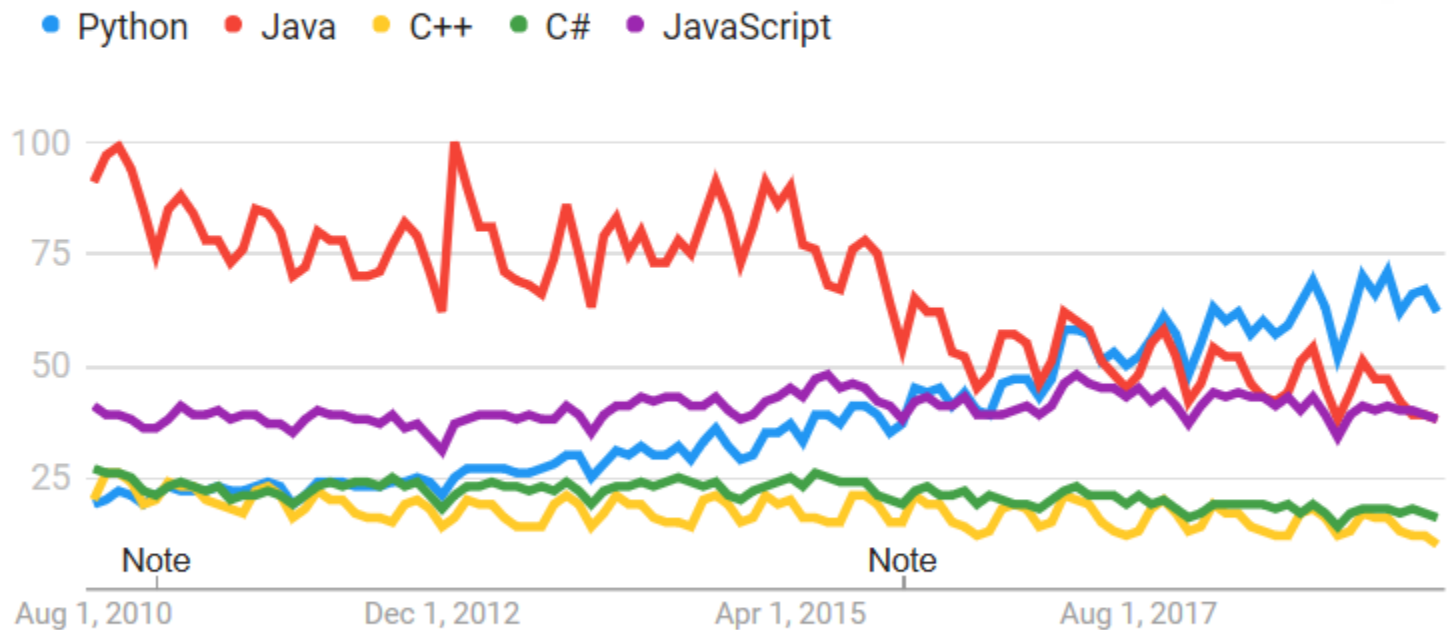
- Imperative vs Declarative Paradigms:
 - Imperative (state-oriented): focused on “how?”
 - Procedural (von Neumann): C, Ada, Fortran
 - Object-oriented: C++, Smalltalk, Eiffel, Java
 - Declarative (goal-oriented): focused on “what?”
 - Functional: Lisp, Haskell, ML, F# (a kind of ML), Erlang, Haskell
 - Logic: Prolog, spreadsheets
- Compiled vs Interpreted Languages:
 - Compiled: C, Assembler
 - Interpreted (scripting): Perl, Python, PHP, JavaScript
 - Partly compiled & partly interpreted: Java, C#

Python Popularity in Google Trends

Interest over time

United States. 7/21/10 - 8/21/19 Web Search.

Google Trends



Google Trends

2018 vs 2015 Interactive Top



Choose a Ranking (choose a weighting or make your own)

IEEE Spectrum | Trending | Jobs | Open | Custom

Edit Ranking | Remove Comparison |

Choose a Comparison (choose a weighting or make your own)

IEEE Spectrum | Trending | Jobs | Open | Custom

Edit Ranking

Language Types (click to hide)

Web | Mobile | Enterprise | Embedded

Language Rank	Types	Spectrum Ranking	Custom Ranking
1. Python		100.0	100.0
2. C++		99.7	99.9
3. Java		97.5	99.4
4. C		96.7	96.6
5. C#		89.4	91.5
6. PHP		84.9	85.1
7. R		82.9	84.6
8. JavaScript		82.6	83.3
9. Go		76.4	76.2
10. Assembly		74.1	73.1
11. Matlab		72.8	72.6
12. Scala		72.1	71.3

Choose a Comparison (choose a weighting or make your own)

IEEE Spectrum | Trending | Jobs | Open | Custom

Edit Ranking

Language Types (click to hide)

Web | Mobile | Enterprise | Embedded

Compare a ranking. Click a data source to toggle its inclusion in the ranking and drag its slider to reweight it.



Use data from: 2018 | 2017 | 2016 | 2015 | 2014

Google (search) <input type="range" value="50"/>	Google (trends) <input type="range" value="50"/>
Github (active) <input type="range" value="50"/>	Github (created) <input type="range" value="30"/>
Stack Overflow (?s) <input type="range" value="30"/>	Stack Overflow (views) <input type="range" value="30"/>
Reddit <input type="range" value="20"/>	Hacker News <input type="range" value="20"/>
Career Builder <input type="range" value="5"/>	Dice <input type="range" value="5"/>
Twitter <input type="range" value="20"/>	IEEE Xplore <input type="range" value="100"/>

Cancel | Save as Custom

Why Python?



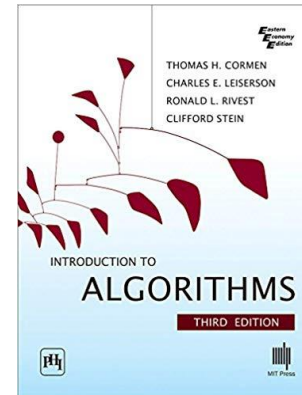
- Python is an *interpreted* language – C is *compiled* language
- Python is *higher-level* than C, being characterized by:
 - Simple and readable syntax
 - Dynamic typing
 - High-level data types
- Python is a *general-purpose* programming language popular for:
 - **Algorithms – close to pseudocode, fast prototyping and testing**
 - AI / ML / DS
 - Scientific (Math)
- Python is *multi-paradigm* supporting different styles of programming enabling comparisons of readability / comprehensibility and efficiency / speed
- Plethora of *tools*:
 - Jupyter Notebook 
 - PyCharm by JetBrains 

Courses



■ Algorithms Design

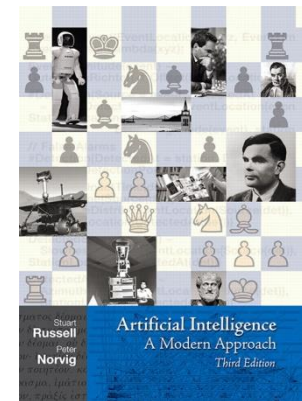
□ 1st year, 2nd semester CE



@ CLRS

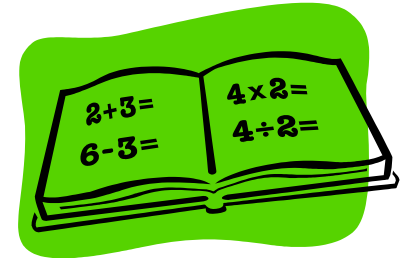
■ Artificial Intelligence

□ 2nd year, 2nd semester CE



@ AIMA

Algorithms Design – Overview



- Learning objectives:
 - **LO1:** *Principles of algorithm analysis, modular programming and data abstraction.*
 - **LO2:** *Fundamental algorithms and fundamental methods of algorithm design.*
 - **LO3:** *Practical experience in programming small-scale experiments involving implementation, testing and evaluation of algorithms.*
- Practical work is focused on algorithm implementation:
 - Standard C
 - Python
- Exposure to Python
 - Very basic: program structure, functions, modules
 - Operations with Python lists
 - Focus on *self-learning*

Assignments in AD



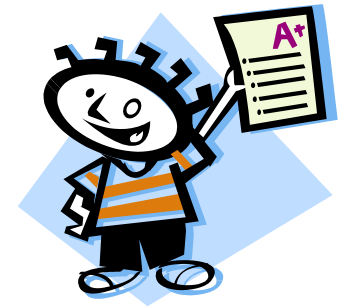
- 2 lab assignments
 - C implementation compulsory
 - Python implementation – optional
- 1 course assignment (homework)
 - C & Python implementations – compulsory
- Assignment tasks:
 - Program algorithms using C and possibly Python
 - Prepare few (usually 5) non-trivial test cases and use them to experiment with the code
 - Prepare technical report describing the work

Google Classroom



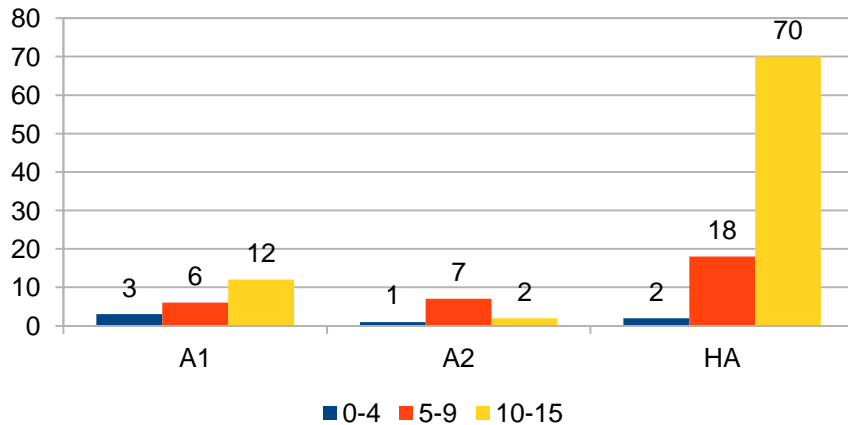
A screenshot of a web browser displaying the Google Classroom interface for a course titled "Algorithm Design 2018-19" under the category "Computers". The browser's address bar shows the URL "classroom.google.com/w/MzA1OTUzOTg3MzVa/t/all". The interface features a top navigation bar with tabs for "Stream", "Classwork", "People", and "Grades", with "Classwork" currently selected. On the left side, there is a sidebar menu with a search icon and a list of topics including "Despre curs / About ...", "Introducere in algorit...", "Analiza algoritmilor / ...", "Corectitudinea si tes...", "Divide-et-impera / Di...", "Sortare rapida. Selec...", "Tipuri de date abstra...", "Stive si cozi, cozi cu ...", and "Grafuri si arbori / Gr...". The main content area displays a list of classwork items: a "Course Assignment" due on Jun 2 at 11:59 PM, "Exam grades" posted on Jun 9, a section titled "Despre curs / About the Course" with a sub-item "Despre curs / About the Course" posted on Feb 19, another section titled "Introducere in algoritmi / Introduction to Algor..." edited on Mar 12, and "Capitolul 1 / Chapter 1" edited on Mar 12. The interface includes standard browser navigation controls and a user profile icon in the top right corner.

AD Lab Assignments Results

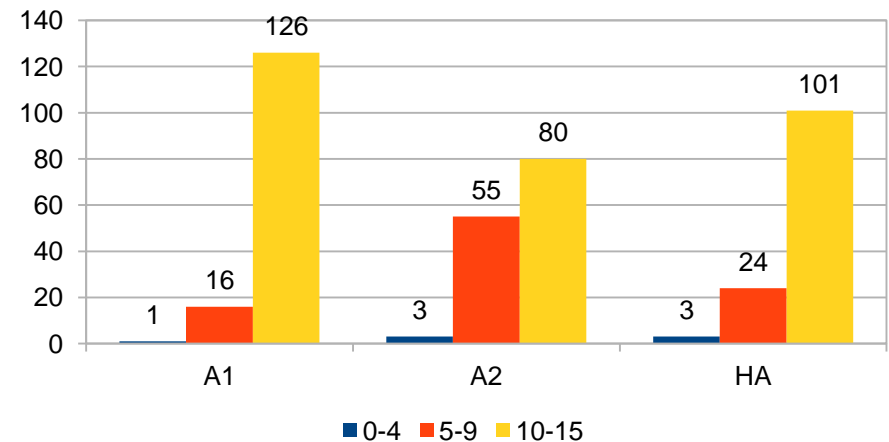


	Python			C		
	0-4	5-9	10-15	0-4	5-9	10-15
A1	3	6	12	1	16	126
A2	1	7	2	3	55	80
HA	2	18	70	3	24	101

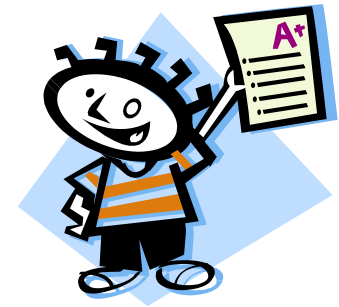
Python



C

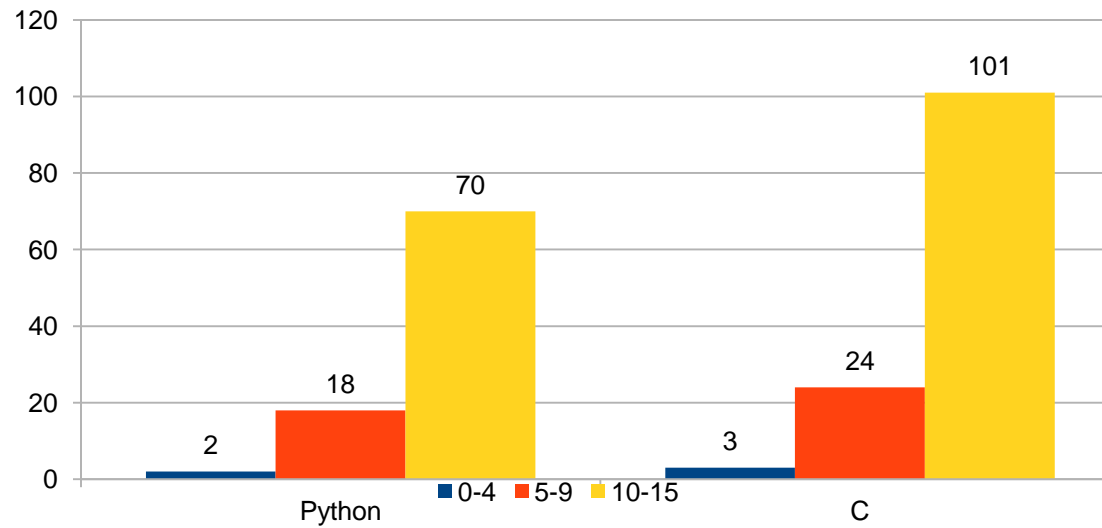


AD HW Assignment Results

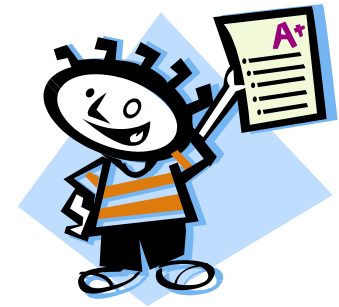


Homework Assignment			
	0-4	5-9	10-15
Python	2	18	70
C	3	24	101

Homework Assignment

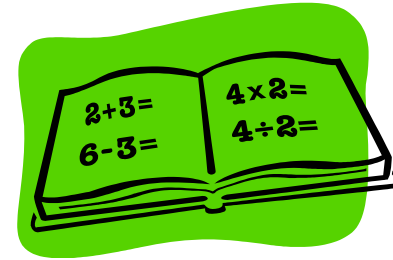


AD – Summary



	Total number of students	169
A1	Total number of submissions	143
	Submissions with Python	21
A2	Total number of submissions	138
	Submissions with Python	10
HW	Total number of submissions	138
	Submissions with Python	90

Artificial Intelligence – Overview



- Introduction to basic AI topics
- Follow the traditional approach – AIMA textbook
- Main topics:
 - Logic
 - Problem solving (searching): uninformed & informed
 - Constraint satisfaction
 - Probabilistic reasoning
 - Semantic networks
- Practical Work
 - Prolog as practical application of logic
 - Implementation of AI algorithms using various programming languages

Popularity of AI-Related Disciplines

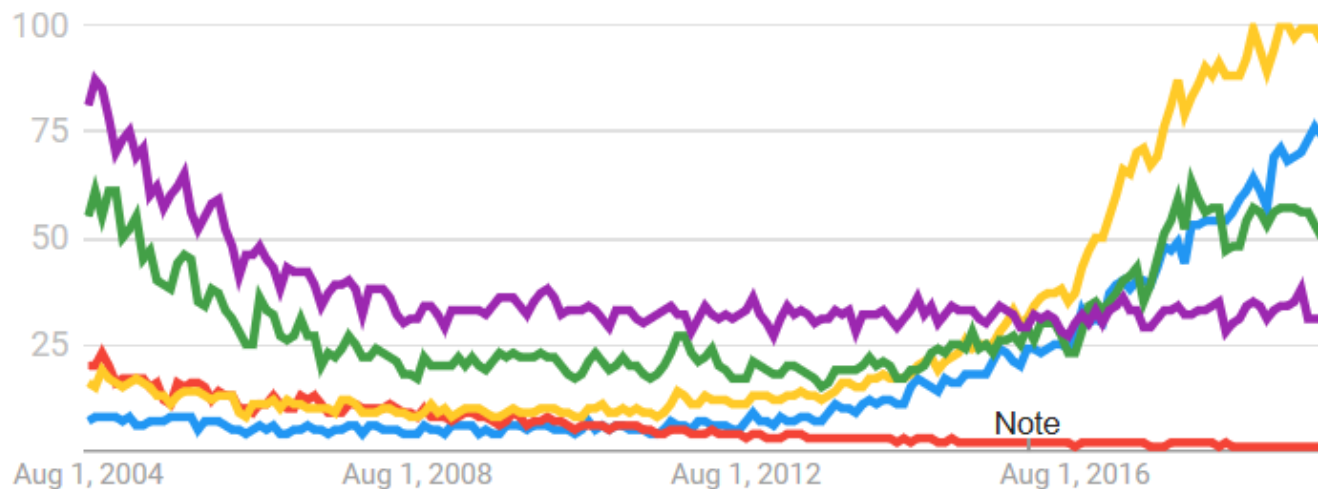
Google Trends

Interest over time

Worldwide 7/21/04 - 8/21/19. Web Search.

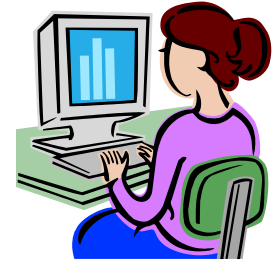


- data science
- Semantic Web
- Machine Learning
- Artificial Intelligence
- Software Engineering



Google Trends

AI Assignments



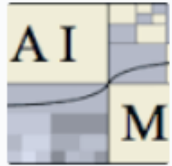
- 2 lab assignments A1 and A2
 - A1: use of Prolog was compulsory (not considered here)
 - A2: use of Python was compulsory
- 1 course assignment (homework) HW
 - Programming language was chosen by the student
- Assignment tasks:
 - Program AI problems / algorithms
 - Prepare few non-trivial test cases and use them to experiment with the code
 - Prepare technical report describing the work

Google Classroom



A screenshot of a Google Classroom interface. The browser tabs at the top include 'Classwork for Artificial Intelligenc...', 'google classroom - Căutare Goo...', and 'Google Traducere'. The address bar shows 'classroom.google.com/w/MzA0MTA0MjkwMjBa/t/all'. The page title is 'Artificial Intelligence 2018-19' with a sub-header 'Computers'. Navigation tabs include 'Stream', 'Classwork', 'People', and 'Grades'. A left sidebar lists various topics like 'Modele de exercitii s...', 'Situatie studenti', 'Despre curs', etc. The main content area shows a list of assignments: 'Assignment 1' (Due Apr 7, 11:59 PM), 'Assignment 2' (Due May 20, 11:59 PM), 'Course Assignment' (Due Jun 10, 11:59 PM), 'Rezultate Calculatoare Engleza' (Posted Jun 21), 'Rezultate Calculatoare Romana' (Posted Jun 23), and 'Intrebari Prolog' (Edited Mar 12). A large blue heading 'Modele de exercitii si subiecte examen' is also visible.

Code Base – AIMA



aimacode

Code for the book "Artificial Intelligence: A Modern Approach"

Berkeley, CA <http://aima.cs.berkeley.edu> peter@norvig.com

Repositories 13

Packages

People

Projects

Find a repository...

Type: Sources

Language: All

13 results for source repositories

Clear filter

aima-python

Python implementation of algorithms from Russell And Norvig's "Artificial Intelligence - A Modern Approach"

Jupyter Notebook MIT 1,835 3,946 81 (2 issues need help) 47 Updated 2 hours ago



aima-javascript

Javascript visualization of algorithms from Russell And Norvig's "Artificial Intelligence - A Modern Approach"

JavaScript MIT 186 392 16 5 Updated 3 days ago



@ itchronicles.com

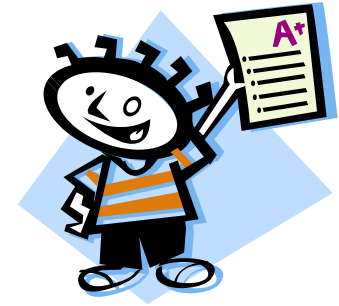
Top languages

JavaScript Java C# Julia HTML

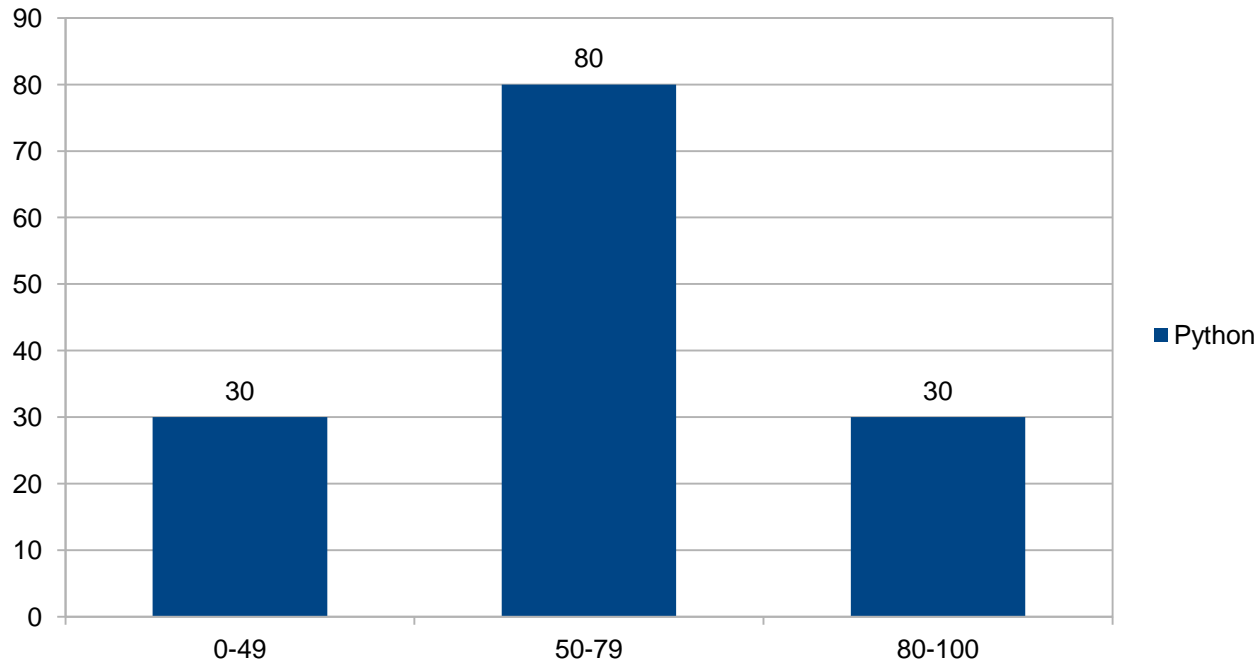
People

This organization has no public members. You must be a member to see who's a part of this organization.

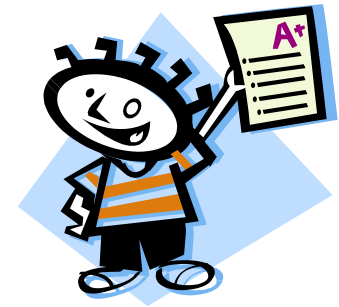
AI Lab Assignment 2 Results



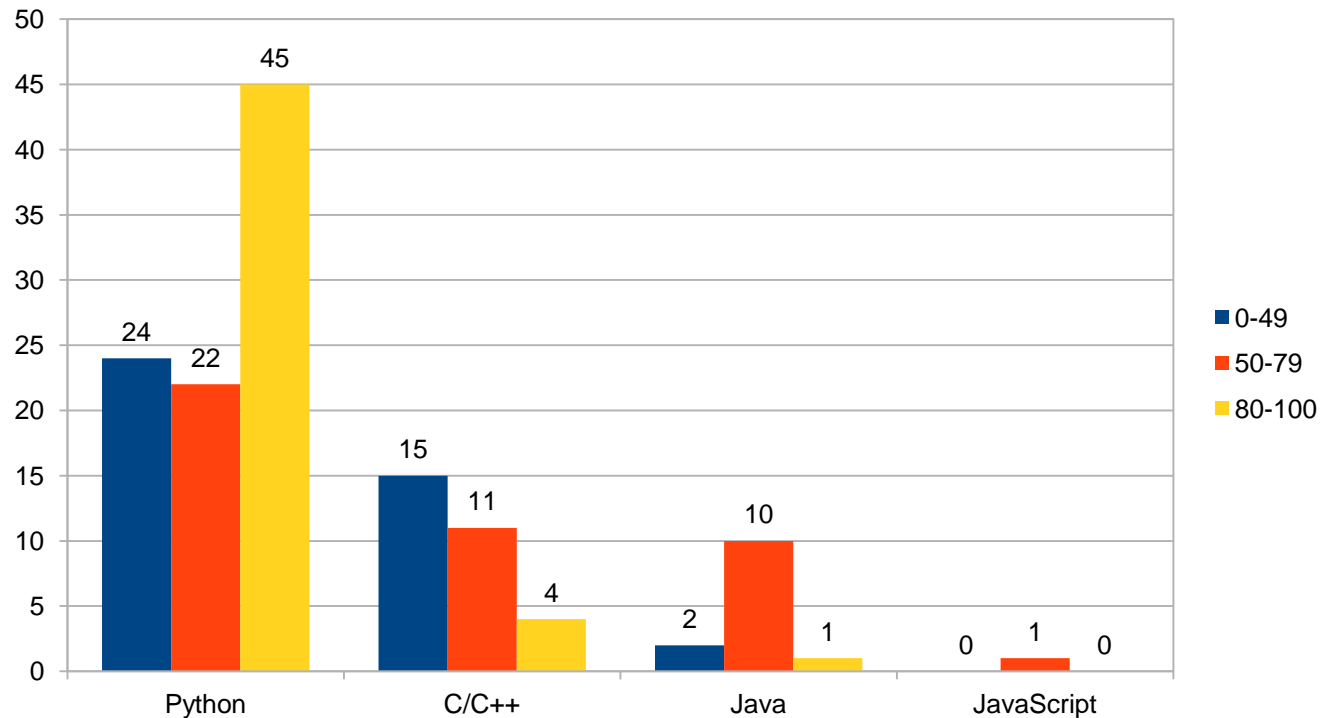
Assignment 2			
	0-49	50-79	80-100
Python	30	80	30



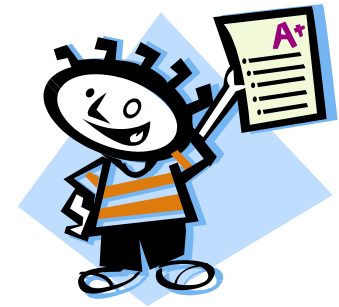
AI HW Assignment Results



	Homework Assignment		
	0-49	50-79	80-100
Python	24	22	45
C/C++	15	11	4
Java	2	10	1
JavaScript	0	1	0



AI – Summary



	Total number of students	194
A2	Total number of submissions	140
	Submissions with Python	140
HW	Total number of submissions	165
	Submissions with Python	91

Educational Issues



- 2nd year students did better with Python programming. They had additional Python knowledge from Object-Oriented Programming course.
- Hints given to 1st year students during AD course regarding self-instruction with Python were very useful – for example *using Python to solve simple algorithmic projects on Project Euler*.
- Despite only very basic exposure to Python, most of 1st year students responded well to Python adaptation, about 75% obtaining good results at the HW assignment.
- To increase Python acceptance, we decided to dedicate at least one lab session to Python during next year AD course.

Conclusions



- We presented our approach for introducing Python language to 1st year students.
- We presented our focus on Python of 2nd year students of introductory AI course.
- We presented the outcomes of using Python in practical work at AD & AI courses.

