
Introduction To ApCoCoA - Tutorial

CAA Workshop 7-13 Oct. 2017 Douala

Ap: Applied

Co: Computations in

Co: Computer

A: Algebra.

1 Installation ApCoCoA

Install Java

Windows:

- Download **java** and install java by double clicking on the setup.

Linux: In the terminal type the following command.

- **sudo apt-get update**
- **java -version** *If it returns "The program java can be found in the following packages", Java hasn't been installed yet, so execute the following command:*
 - **sudo apt-get install default-jre**
Java Runtime Environment (JRE). If you need the Java Development Kit (JDK), which is usually needed to compile Java applications (Apache Ant, Apache Maven, Eclipse and IntelliJ IDEA execute the following:
 - **sudo apt-get install default-jdk**

Mac: In the terminal type the command.

- **brew cask info java** to verify which java you have. If you do not have then continue.
- **brew update**
- **brew cask install java**

Install Eclipse

Just download and install eclipse via the link <http://www.eclipse.org/downloads/eclipse-packages/>

Download ApCoCoa

<http://apcocoa.uni-passau.de/wiki/index.php?title=ApCoCoA:Downloads>

2 Exercises

Exercise 1 Basic Computations

- (a) Let $A := 7$ and $B := 5$. Compute the
- $C := A + B$
 - $D := C^2 - A * B$
 - $E := | -\frac{B}{A} |$.
- (b) Compute the summation of the first ten integers number.
- (c) Check if $2^{2^3} + 1$ and $2^{2^3} - 1$ are prime numbers.
- (d) Compute the $\text{gcd}(14175, 1922)$.

Exercise 2 Lists

- (a) Create a list containing seven zeros.
- (b) Create a list of the first ten integers.
- (c) Calculate the sum of the first ten prime numbers.
- (d) Let $L_1 := \{1, 2, 3, 4, 5, 6, 7, 8\}$ and $L_2 := \{3, 4, 5, 7, 9, 0, 13\}$.
- Create a list L_3 which contains element of L_1 which are not in L_2 .
 - Insert 20 in the third position of L_2 .
 - Append 0 in L_1 .
 - Compute $L_3 \cup L_2$ and $L_3 \cap L_2$. Do we have $L_3 \cap L_2 = \emptyset$?

Exercise 3

- (a) Create a list L of prime number less than 100.
- (b) How many elements are in L .
- (c) Insert the letter "c" in the 5th position in L .
- (d) Compute all the subset of the set $S = \{1, 2, 3\}$. How many subset of S do we have?
- (e) Check if the set $\{3, 4\}$ is a subset of S .

Exercise 4

- Let $K = \mathbb{Q}$ and $P = K[x, y, z]$. Let

- Compute $x * T_2$ where $T_2 := \{x, xy, 1, x\}$ with respect to *Lex*, *DegLex*, and *DegRevLex*.
- Compute the intersection $T_2 \cap x * T_2$ and the union $x * T_2 \cup T_2$.
- $T_2 = x * T_2$?

Exercise 5

Let $K = \mathbb{Q}$, let $V = K^4$, and let φ_1 and φ_2 be the endomorphisms of V defined by the matrices

◇ Let $M = \begin{pmatrix} 1 & 0 & 4 \\ 1 & 2 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, and $X = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$. Solve the equation

$$M \cdot X = B$$

• Let $A = \begin{pmatrix} 0 & 0 & 4 \\ 1 & 2 & 3 \\ 1 & 1 & 0 \end{pmatrix}$.

- Compute the determinant of the matrix A .
- Find the kernel of the endomorphism defined by the matrix A .
- Compute the minimal polynomial of the matrix A .
- What is the rank of the matrix A ?

Exercise 6

Write a function **MySum** which take as input a integer n and return the sum of all integer less or equal than n .

Exercise 7

Write a function **IsPrim** which checks if a number is prime or not.