香 港 資 優 教 育 學 苑
The Hong Kong Academy for Gifted Education

SageMath programming towards problem solving (MATP1061)

Introduction	In most of the mathematical competitions, electronic devices are usually forbidden. How can you solve the following questions with the aid of computers? ● What is the leftmost digit of 3^{100}? ● What are the rightmost two digits of the 1000^{th} Fibonacci number? ● What is the largest prime number within 2025? ● How many digits does 1000! have? SageMath is a fully open-source software system. It is free and available worldwide for all including private, commercial, and governmental parties. SageMath aims to provide everything mathematicians, researchers, and students need for calculations. The course, a hands-on computer workshop, will begin by introducing SageMath and online submission. Student members would learn the functionality of SageMath and solve various competition problems。
Programme Type / Level	Across Domains and Interdisciplinary Course (Level 1) (Token-required)
Instructor(s)	Mr Wu Kai Chiu A researcher in Mathematics and Computer Science. His interests include control theory, theoretical computer science, formal languages and symbolic computation. His research awards include The Best Paper in Conference Held in Cambridge and National Honourable Mentioned Thesis. He has been an organising committee member of various mathematical competitions. He was a teacher in mathematics and computer science in St. Paul's College.
Pre-requisite	**Mathematics:** Students should be able to: (1) Perform arithmetic operations on integers，decimal and simple fractions; (2) Solve algebraic equations； (3) Have knowledge of number sequences, divisibility, composite numbers, prime numbers, counting and mathematics competition problems is an advantage but not necessary. **Computers:** Students should be able to: (1) Use Google Chrome; (2) Search and learn through Khan Academy, Wikipedia, MathWorld, OEIS and AoPS; (3) Have a personal Google account and Github account; (4) Make online submission.
Target Participants	➢ P4 to P6 HKAGE student members ➢ Class size: 24
Medium of Instruction	Cantonese with Chinese/English handouts
Certificate	**E-Certificate** will be awarded to participants who have: ❖ Attended **AT LEAST 3** sessions AND ❖ Completed all the assignments with satisfactory performance

Intended Learning Outcomes

Upon completion of the course, students should be able to:

- Investigate the concepts of modular arithmetic;
- Compute arbitrary digits of sequences;
- Explore number of primes and number of divisors;
- Develop creativity in solving a few competition problems.

Screening

Please answer the screening question in the online application form.
*The screening question is designed to help the applicant understands the course level and the course content. The question must be answered by the student applicant and it can only be attempted once. The answer cannot be changed once the application is submitted. Selection is based on students' performance in answering the question. Only students who can demonstrate motivation，the knowledge of Mathematics and computer in the screening question can be enrolled in the programme.

Application Deadline

29 Apr, 2019 12:00 n.n

Application Result Release Date

10 May, 2019

If student members withdraw from the programme after the Application Deadline, the token will be deducted.

Schedule

Session	Date	Time	Venue
~~1~~	~~17 Jul~~	9:30 a.m. – 12:30 p.m.	~~HKPC Building 125~~
2	20 Jul		HKAGE Room 303
3	24 Jul		HKAGE Room 403
4	27 Jul		HKAGE Room G01
Make-up	31 Jul		HKAGE Room 403

The make-up class will not be counted in the calculation of attendance. However please also be reminded that E-Certificate will be awarded to participants who have completed all the assignments with satisfactory performance other than the attendance requirement.

Sample Example for the Programme

Fibonacci sequence

The Fibonacci sequence is:1,1,2,3,5,8,13,\cdots1,1,2,3,5,8,13,⋯

The n^{th}n_{th} term is usually denoted F_nF_n.

We use `L = [1,1,2,3,5,8,13]` to specify a list (zero-indexed sequence) and stores it to `L`.

One can access the 1^{st}1_{st} term with `L[1]`.

```
L = [1,1,2,3,5,8,13]
```

Zero-th index property

In programming, list/sequence are usually indexed from zero.

It is common to extend the sequence by the zero-th term, i.e. when n=0$n=0$.

Recall thatF_{n+2} = F_{n+1} + F_n$F_{n+2}=F_{n+1}+F_n$, by setting n=0$n=0$, we have F_n = 0$F_n=0$.

```
F = [0,1,1,2,3,5,8,13]
```

Thus, we can align the index in sage as usual sequence.

Enquiries  For enquiries, please contact us at 3940 0101 after language selection, press "1".