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Hands-on Workshops –
SDG 4. Quality Education

Workshop title:	Cyber Security
Workshop owner: (Name of School/ Institution/University/Organization)	LKC FES - Centre for Cyber Security And Malaysian Society for Cryptology Research (MSCR)
Description of workshop: (objective, content, etc)	**Objectives:** 1. To introduce and promote cyber security. 2. To demonstrate basic cryptography ciphers using simple Python programming. 3. To introduce various types of combinatorial games and their applications to real world problems. **Introduction:** The objective of these activities is to introduce some basic ciphers / cryptosystems in cryptography to younger generation. In align with the revoultion of industry 4.0 and the advancement of IoT devices, the promotion of the awareness of cybersecurity is important. Beside that, by attending the mini workshop on Phython and by playing the proposed pencil-and-paper games, participant can appreciate the importance of combinatorial mathematics in cryptography and it applications to the field of engineering and computer science. **Activities:** **A. Reverse and Ceaser Ciphers** In this mini workshop, participant will be introduced to two basic ciphers in cryptography, which are, the Reverse cipher and the Ceaser cipher. Participant will be given the chance to explore to Python programming which is used to implement the mentioned ciphers. Instructor will guide participants to modify the encrypted message and modify the Python source code. A sample source code is shown in the following Figures 1 and 2. Throughout this mini workshop, participants are exposured to simple cryptography primitives and also will appreciate the power of programming in the implementation of simple algorithm.

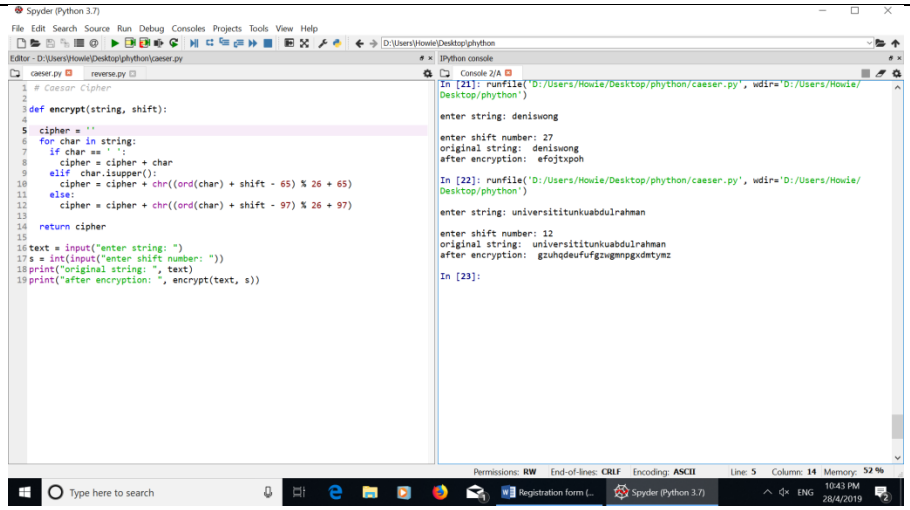

Figure 1: Reverse cipher source code

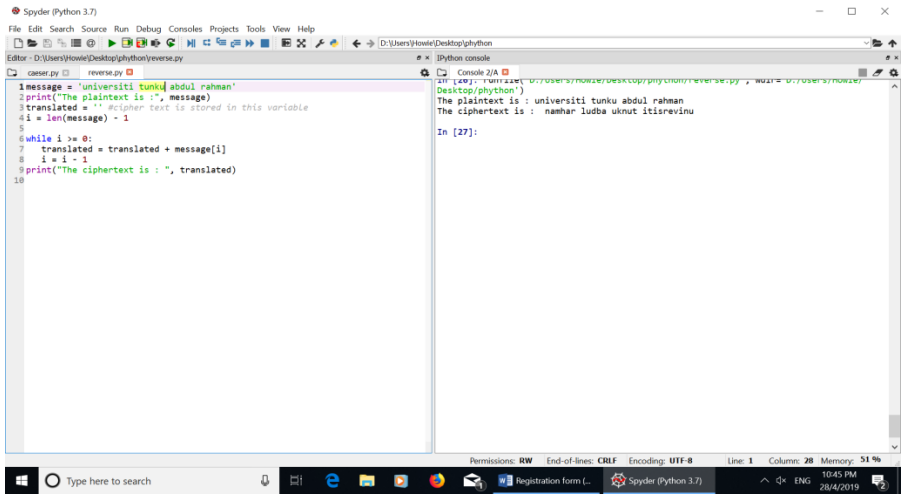

Figure 2: Reverse cipher source code

B. A graph game: Game of Sim

Sim is a pencil-and-paper game that is played by two players. On a paper six dots are drawn. Each dot is connected to every other dot by a line. Two players will take turn to color any uncolored lines. One player colors in one color, and the other colors in another color, with each player trying to avoid the creation of a triangle made solely of their color. The game is restricted by the constraints - only triangles with the dots as corners count; intersections of lines are not relevant. At the end of the game, the player who completes a triangle loses immediately. Refer to Figure 3 for a simle illustration.

The six dots with all lines connected between any two dots give a complete graph K_6, and the famous Ramsey theorem asserts that K_6 must contain a monochromatic triangle, and hence there is no tied game.

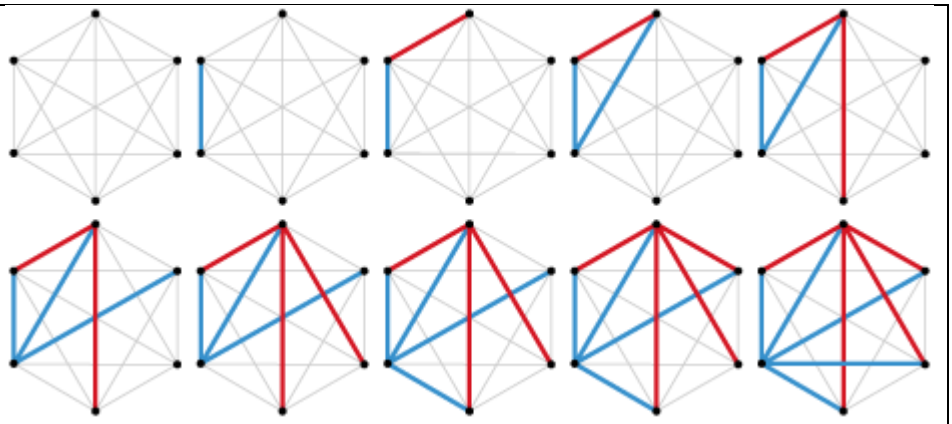

Figure 3: Game of sim illustration

Aplications:
Complete graph analysis
Computer network design
Cryptography attacks

C. A combinatorial game: Dots and Boxes

Dots and Boxes is a pencil-and-paper game for two players. The game starts with an empty grid of dots. Two players take turns adding a single horizontal or vertical line between two unjointed adjacent dots. A player who completes the fourth side of a 1×1 box earns one point and takes another turn. A point is typically recorded by placing a mark that identifies the player in the box, such as an initial. The game ends when no more lines can be placed. The winner is the player with the most points. Refer Figure 4 for a simple game illustration.

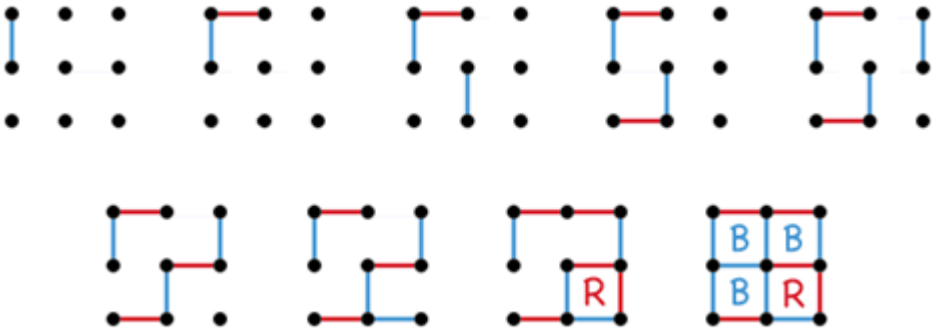

Figure 4: Dots and Boxes illustration.

The board may be of any size grid. When short on time, or to learn the game, a 2×2 board (3×3 dots) is suitable.

After completing this game, the gamer will be explained on how to use chain, double-cross and open first long chain strategies to win the game.

	In combinatorial game theory, dots and boxes is an impartial game and many positions can be analyzed using Sprague–Grundy theory. Applications: Combinatorial game design Cryptography attack Computer network design
Age group:	Primary school (7 - 12 years old) Secondary school (13 - 18 years old)
Group size:	2 persons x 4 groups
Number of session: **Duration per session** (eg. 30 minutes)**:** **Time** (eg. 9.00am – 9.30am)**:**	9 sessions per day 30 minutes per session 9.00 am – 9.30 am 10.00 am – 10.30 am 11.00 am – 11.30 am 12.00 pm – 12.30 pm 1.00 pm – 1.30 pm 2.00 pm – 2.30 pm 3.00 pm – 3.30 pm 4.00 pm – 4.30 pm 5.00 pm – 5.30 pm

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