THE BIG PICTURE: Capture the Flag (CTF) Competitions for Cybersecurity Education and Curriculum

Security competitions are emerging as a new plug-in approach to traditional cybersecurity (CSEC) education. With the gradual introduction of CTFs at universities, the CSEC curriculum now covers popular topics, including Forensics, Reverse Engineering, and Cryptography. Government agencies, national laboratories, and industry partners sponsored CTFs are held around the United States, catering to high school students, college students, and even professionals worldwide. This experiential learning approach has attracted its learners to use it as a preparation mode for cybersecurity work roles stepping into the industry. So, what are some elements to consider when approaching CTFs for CSEC Curriculum?

Research Questions:

1. Studying types of CTFs and which one is more suited to enhance education?
   - Research Questions:
     1. What categories are popularly covered by CTFs
     2. Challenges analysis for engaging beginners in online CTF competitions for Security Education
     3. What other categories should be covered by CTFs to enhance CSEC education. (Note: bring categories from educational frameworks)
     4. Automatic problem generation for CTF competitions

CTFs for CSEC Education

Types of CTF

- Category 1 (Format)
  - Jeopardy (online and/or on-site)
  - Attack-Defense (mostly on-site)
  - Hybrid (Jeopardy and Attack-Defense)
  - King of the Hill
  - Linear CTF

- Category 2: Educational Vs Industry CTFs (example picoCTF vs DEFCON)

- Category 3: Beginner friendly vs Experienced CTFs

Popular CTF Categories

- Forensics
- Web Exploitation
- Cryptography
- Steganography
- Binary Analysis
- Reverse Engineering
- Pwn

CTFs aimed at

- Middle and High School
- Undergraduate Education
- Graduate Education

Research Questions:

2. Studying CTF hosting platforms and what they offer to enhance education.
3. Analysis of open-source vs paid platforms as a CSEC e-learning tool
4. CTF as a Service
5. Randomness of Hints presented on the basis of learner's experience level