Codebusters!

Grades: 4, 5

Team Size: 1-2 participants

Duration: 30 minutes (including time for instructions)

Supervisors: Jonathan Spencer and Monica Sieh

Summary Description
Teams will be tested on their ability to decode encrypted messages using historical and modern ciphers, including the Atbash, Caesar, Aristocrat, Vigenère, Tap Code, DancingMen, and PigPen ciphers.

Changes from the Previous Year
There are no changes from 2025.

Rules/Competition Format
This event consists of students using cryptanalysis techniques to decrypt messages on a written exam.

1. Teams must not open the exam packet nor write anything before the “start” signal, nor may they write anything after the “stop” signal.
2. Participants are free to answer the questions in any order, working individually or in pairs, and attempting whichever questions seem right for them.
3. The code types that may be used on the exam at the competition are as follows:
    a. Mono-alphabetic substitution **Aristocrats** - messages with spaces/word breaks included - with or without a hint.
    b. **Atbash Cipher** (in English, not Hebrew)
    c. The **Caesar Cipher**, also known as a shift cipher, involves a shift of no more than 3 characters in either direction. (e.g., ‘a’ can map to x, y, z, b, c, or d). The number of shifts used to encrypt the message may or may not be provided.
    d. The **Vigenère Cipher** - Decrypting ciphertext given a key.
    e. The **PigPen Cipher**, also called the Masonic Cipher - Decrypting ciphertext with no mapping table provided.
    f. The **Tap Code Cipher** - Decrypting ciphertext encoded by a pair of numbers indicating a coordinate in a standard 5x5 table (not provided with the test), with c and k sharing the same cell.

   g. The **DancingMen Cipher** - Decrypting ciphertext encoded by DancingMen symbols based on the Sherlock Holmes story “The Adventure of the Dancing Men.”
4. For the Aristocrat Cipher, no letter can ever decrypt to itself.

Scoring

1. Highest score wins.
2. Based on difficulty, each question will be worth a clearly indicated number of points.
3. For all questions, the final points will be determined based on the number of errors found.
   a. Each spelling error or missed character counts as one error.
   b. Two or fewer errors will result in full credit.
   c. Each additional error results in a penalty of 50 points.
   d. The penalty will not exceed the value of the question. For example, a 200-point question with four errors is worth 100 points, whereas the same 200-point question with seven errors would be worth 0 points, not -50.
   e. The points for each solved cipher will be added to determine the exam score.
   f. Tie breakers: For teams that are tied, select questions predetermined by the event supervisor (not shared with the teams) will be used to break the tie using the following criteria in order: score, degree of correctness (number of correct letters), and attempted.

Materials Distributed by WESO
None

Materials to be brought to the competition
All materials needed for the competition will be provided by WESO.

- No external calculators, phones, watches, rulers, pens, books, notes, or other similar items are allowed.
- No resource materials, except those provided by the Event Supervisor, may be used.
- The Event Supervisor will provide scratch paper for each team to use.
- The exam packet will be loose inside a folder (not stapled), allowing the teams to divide and share the pages with their teammate. The packet will also include two resource sheets for each team member to use. The resource sheet will include English letter frequencies, Vigenère Table, Atbash Table, and DancingMen Table.

Event Questions

Please go to https://wesoscience.org/events/ for information on how to submit questions about this event.

Additional Coaching Suggestions, Resources, and References

1. **Toebes Science Olympiad Codebusters Website (https://toebes.com/codebusters/)**
   Bookmark this website! It contains just about everything you need for this event:
   a. Guides for how to use each cipher.
   b. Practice tests from previous years.
   c. A test-generating tool to create your own tests to give to your kids.
   d. The WESO exam will be generated through this tool, so use this website to get the students used to the format.
2. **Practice and competition tips**
   a. Introduce a new cipher each practice and work through a few examples. Then create some sample ciphers using the Toebes tool to let your students practice.
   b. Repeat the cipher you taught in the previous practice as the first cipher that the students try in the following practice, so they don't forget how to do it.
   c. Have them practice both as teammates and individually to allow them to identify their strengths and weaknesses with each cipher.
   d. Practice in timed conditions! The biggest problem students have in Codebusters is running out of time by spending too much time on a difficult cipher. They need to know when it makes sense to abandon a difficult cipher they can't solve, so they can try to answer other ciphers and get some points.
   e. Make at least an attempt to answer all of the ciphers. Sometimes, the difference between two tests that are tied is which team attempted the tiebreaker question. If your team didn't try, they won't win the tiebreaker.
   f. Divide and conquer! The students do not have to work together on the exam. They can take the exam apart and each work on different ciphers.
   g. The exam will be long and will contain more ciphers than they can answer in the allotted time. This will allow the teams to focus on the ciphers they are comfortable with and still gain points for their final score.
3. **Additional Resources**
   a. Science Olympiad Codebusters (https://toebes.com/codebusters/)

b. Codebuster YouTube Channel (https://www.youtube.com/@Codebusters-sciol) - contains videos for how to use the Toebes Tool.
c. CryptoClub (https://www.cryptoclub.org/) - Online decrypting games.
d. Puzzle Baron's Cryptograms (https://www.cryptoclub.org/) - Online decrypting games.