BDAthlon Problem #1
Title: Device Specification and Rule Building with Eugene
Area: Specification and Design

Problem Description:
The creation of synthetic biological systems consists of specifying both the DNA parts required for the design, as well as their relationships to one another. Eugene is a domain specific language for specifying these "structural" relationships. Eugene allows for user defined parts, part types, and compositional rules that can be used to enumerate ordered sets of these parts to create "devices". In this problem you will use Eugene to create designs representing popular synthetic biological devices from the literature.

Objectives:
1. Create Eugene file(s) for the "repressilator" by Elowitz et. al. **Paper attached**.
2. Create Eugene file(s) for the recombinase circuit based topologies described by Roquet et. al. **Paper attached.**
3. Create Eugene file(s) for a design of **your choosing** from the literature.
4. Create a document (in Word, .txt, or PDF) detailing issues you had using Eugene, Eugene Lab, or any other related Eugene resource.

Coding requirements:
You are required to create a set of .eug files (a pure text based Eugene files) using Eugene lab. Eugene lab can be found at the website below. On that site there are examples of various Eugene files as well as documentation on how to use the tool and language itself. You should create Eugene files that describe the parts and the rules to compose the parts to make the devices described. You should create files that encompass not only the designs shown in the paper, but designs that would also satisfy the design requirements shown in the paper give the descriptions of the designs and their requirements. Be creative!

Evaluation Criteria:
Your Eugene solutions will be evaluated on:
  a. Correctness of the generated designs
  b. Appropriate level of constraints - not over or under constrained
  c. Thoroughness of design including part types, part instances, part properties, and rules
  d. Sophistication of the rules and their generation
  e. For objective #3, the judges will look at the appropriateness, sophistication, rigor, and design choices used in your designs. The paper you chose should have "interesting" genetic circuits.

Your issues document will be evaluated on:
  a. Clarity and conciseness
  b. Ability to replicate or demonstrate the issues you present
  c. Presentation of possible solutions to issues as appropriate

You will provide a .zip file of all your .eug files and issues document. Also provide a pdf of the paper you chose for objective #3. Name the files appropriately so that the reviewers understand which problems are for which design from the literature.

Resources:

- www.eugenecad.org – this is the site that has the "Eugene Lab" design tool.
- E. Oberortner, S. Bhatia, E. Lindgren, and D. Densmore, "A Rule-Based Design Specification Language for Synthetic Biology," J. Emerg. Technol. Comput. Syst. Special Issue on Synthetic Biology, vol. 11, iss. 3, p. 25:1–25:19, 2014. **(provided)**
- L. Bilitchenko, A. Liu, S. Cheung, E. Weeding, B. Xia, M. Leguia, J. C. Anderson, and D. Densmore, "Eugene–a domain specific language for specifying and constraining synthetic biological parts, devices, and systems," PLoS ONE, vol. 6, iss. 4, p. e18882, 2011. **(provided)**