IY5612 (Cyber Security) Exercises

Formative Feedback 1 — Please submit no later than 26/2/20

Basic

1. How is a *Critical Infrastructure* differentiated from a service or facility that is critical to the functioning of an individual company?
2. Describe and differentiate between the concept of a *Threat Source* and a *Threat Actor*. Why is a distinction desirable?
3. What is the objective of a *national cyber security strategy*? Identify multiple sub-objectives if necessary.
4. Give a formal definition of a *vertex-independent path*
5. Describe the robustness of Erdős-Rényi random graphs against the *random* removal of $5\%, 25\%$ of vertices: How are key parameters such as the size of the largest connected component and path lengths in the graph affected?

Intermediate

6. Highlight the difference in abstraction between *protection principles* vs. *protection policies* in the development and analysis of (national) security policies.
7. Describe qualitatively (or formally) the definition of the *clustering coefficient* cc both vertices and for graphs.

   How can $cc(v)$ (for a vertex v) and $CC(G)$ (for a graph G) be interpreted intuitively?
8. Describe the concepts of *Vertex Centrality* and *Betweenness Centrality* formally or informally and identify the difference between these two graph metrics.
9. Assume that a social network graph (e.g. *followers* of individuals on Twitter) is approximated by the *Watts-Strogatz* graph model. How is the average path length (identifying individuals following others in a chain until reaching one individual that does not extend this "opinion chain") affected if the size of the social network doubles? Give a reasoned answer.
10. Qualitatively describe the robustness of power-law graphs to *random* removal of 1% of vertices vs. *targeted* removal.

    (a) Which vertices will attackers remove if the attacker is able to remove a fixed number (percentage of nodes) in a one-time attack?

    (b) Will the optimum strategy change if the attacker is allowed to remove half of the vertices in a first round, and half in a second round?

    Give a reasoned answer for both sub-questions (a) and (b).