**Handout for Track7 “dApp Analysis: Exploring the Complex System Oriented Approach”**

**Objective:** this homework aims to deepen your understanding of the network structure of decentralized applications (DApps) through practical application using the MindTheDApp toolchain and Gephi. You will analyze datasets of dApps, visualize their network interactions, and interpret various network metrics.

**Tasks:**

1. **Study the Paper:**
   * **Read the provided paper** titled *MindTheDApp: A Toolchain for Complex Network-Driven Structural Analysis of Ethereum-Based Decentralized Applications* by Giacomo Ibba et al.
   * **Focus on** the methodology for transforming smart contracts into bipartite graphs and the analysis techniques used.
2. **Explore the Dataset:**
   * **Visit the GitHub repository**: [Smart-Contracts-Bipartite-Graph-Generator](https://github.com/giacomofi/Smart-Contracts-Bipartite-Graph-Generator/tree/master/csvs).
   * **Browse through the datasets** of various DApps available in CSV format.
3. **Choose a DApp:**
   * **Select one DApp** from the provided datasets on the GitHub repository (e.g., 1inch.csv).
   * **Download the corresponding CSV file** for your chosen DApp.
4. **Network Visualization with Gephi:**
   * **Import the CSV file into Gephi** to visualize the contract-to-contract network.
   * **Follow these steps:**
     1. **Open Gephi** and create a new project.
     2. **Import your CSV file** into the Data Laboratory in Gephi.
     3. **Switch to the Overview tab** to visualize the network graph.
     4. **Use the layout algorithms** to better arrange the network graph (e.g., Force Atlas, Yifan Hu).
5. **Function-Contract Network Plotting:**
   * **Based on the paper** *DApps Ecosystems: Mapping the Network Structure of Smart Contract Interactions* by Sabrina Aufiero et al., **create a function-to-contract network plot.**
   * **Identify the functions** within the smart contracts and their interactions.
   * **Use Gephi** to create and visualize this network.
6. **Network Metrics Analysis:**
   * **Analyse the network metrics** provided by Gephi for both contract-contract and function-contract networks.
   * **Focus on metrics** such as:
     1. **Degree**: Number of connections a node has.
     2. **Betweenness Centrality**: Measures the extent to which a node lies on paths between other nodes.
     3. **Closeness Centrality**: Indicates how close a node is to all other nodes in the network.
     4. **Modularity**: Identifies the community structure within the network.
7. **Report:**
   * **Prepare a report** documenting your findings. Include:
     1. **Introduction**: Brief overview of the DApp you chose and the goals of your analysis.
     2. **Methodology**: Steps you took to import data, visualize networks, and analyze metrics.
     3. **Results**: Screenshots of your network visualizations and interpretations of the network metrics.
     4. **Discussion**: Insights gained from the network structure and metrics, potential security vulnerabilities, and overall network efficiency.

**Submission:**

* **Due Date:** 28/05/2024
* **Format:** Submit your report as a PDF document via <https://drive.google.com/drive/folders/1_6XWa0cThWZMokDrvdEc-xbg_qnteZzJ>
* **File Naming Convention:** **Lastname\_Firstname\_MindTheDApp\_Homework.pdf**

**Resources:**

* [MindTheDApp Paper](https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=10436108)
* [GitHub Repository for DApp Datasets](https://github.com/giacomofi/Smart-Contracts-Bipartite-Graph-Generator/tree/master/csvs)
* [Gephi Software Download](https://gephi.org/)

**Note:**

* **Ensure you properly cite** any external resources you refer to in your report.
* **Feel free to explore** additional functionalities in Gephi and the dataset for a more comprehensive analysis.
* **This submission \*is not\* relevant for receiving the NFT.**

Good luck and enjoy your exploration of DApp network structures!