# Project Title: Analysis of Infrastructure Operational Efficiency Based on Time-Varying Network Approach

## Project Overview

This project aims to analyze data related to the execution time of tasks and their information requirements, and calculate the degree of nodes, operation cost, operation efficiency of nodes, and the overall efficiency of the network. The project mainly consists of multiple steps including data processing, matrix operations, and efficiency calculations, and finally outputs a series of result files arranged by time.

## File Structure

### Code Files

- ` Task Driven Evaluation.py`: The main program file, which includes the entire process from data reading, processing to result output.

### Data Files

- `A运行任务记录.xlsx`: Records the time information of running tasks.

- `B运行任务的信息需求.xlsx`: Records the information requirements corresponding to running tasks.

- `C运行信息对应的邻接矩阵.xlsx`: Contains the adjacency matrix corresponding to running information.

- `D社会节点成本记录.xlsx`: Records the cost information of social nodes.

- `E技术节点成本记录.xlsx`: Records the cost information of technical nodes.

- `F节点运行容量赋值.xlsx`: Records the operation capacity information of nodes.

- `G节点权重及属性.xlsx`: Records the weight information of nodes.

### Output Files

- `1按时间排列的运行任务列表.csv`: The output of the first step, a list of running tasks arranged by time.

- `2按时间排列的运行信息列表.csv`: The output of the second step, a list of running information arranged by time.

- `综合邻接矩阵文件夹`: The output of the third step, containing the combined adjacency matrix files.

- `3按时间排列的节点度数（运行信息数量）.csv`: The output of the fourth step, the degree of nodes arranged by time.

- `4按时间排列的节点运行成本.csv`: The output of the fifth step, the operation cost of nodes arranged by time.

- `5按时间排列的节点运行效率.csv`: The output of the fifth step, the operation efficiency of nodes arranged by time.

- `6按时间排列的网络运行效率.csv`: The output of the sixth step, the overall operation efficiency of the network arranged by time.

## Code Workflow

### First Round of Checks: Steps 1 - 3

1. \*\*Step 1: Read the Time Settings of Running Tasks\*\*

- Read the time information of running tasks from `A运行任务记录.xlsx`.

- Extract the `Code` and `Time` columns, process the time ranges, and store the tasks at each time point in a dictionary.

- Convert the dictionary into a DataFrame, sort it by time, and save it as `1按时间排列的运行任务列表.csv`.

2. \*\*Step 2: Read the Information Requirements of Running Tasks\*\*

- Read the information requirements of running tasks from `B运行任务的信息需求.xlsx` and establish a mapping relationship.

- Read the `1按时间排列的运行任务列表.csv` generated in the previous step and obtain the corresponding running information codes for each time point.

- Output `2按时间排列的运行信息列表.csv`.

3. \*\*Step 3: Generate the Combined Adjacency Matrix\*\*

- Read `2按时间排列的运行信息列表.csv` and `C运行信息对应的邻接矩阵.xlsx`.

- For each time point's running information codes, extract the corresponding adjacency matrices and merge them.

- Save the merged matrix in the `综合邻接矩阵文件夹`.

### Second Round of Checks: Steps 4 - 6

1. \*\*Step 4: Calculate the Node Degree (Number of Running Information)\*\*

- Read the matrix files in the `综合邻接矩阵文件夹`.

- Calculate the total number of inputs and outputs for each node and output `3按时间排列的节点度数（运行信息数量）.csv`.

2. \*\*Step 5: Calculate the Node Operation Cost and Operation Efficiency\*\*

- Read `3按时间排列的节点度数（运行信息数量）.csv`, `D社会节点成本记录.xlsx`, `E技术节点成本记录.xlsx`, and `F节点运行容量赋值.xlsx`.

- Calculate the operation cost and operation efficiency of each node at each moment, and output `4按时间排列的节点运行成本.csv` and `5按时间排列的节点运行效率.csv` respectively.

3. \*\*Step 6: Calculate the Overall Network Efficiency\*\*

- Read `G节点权重及属性.xlsx` and `5按时间排列的节点运行效率.csv`.

- Calculate the overall network efficiency at each time point and output `6按时间排列的网络运行效率.csv`.

### Third Round of Checks: Step 7

Currently, there is no specific implementation content for the seventh - step check in the code.

## Operating Environment

- Python 3.x

- Dependent Libraries: `pandas`, `networkx`, `os`

## Running Steps

1. Ensure that all data files (`A运行任务记录.xlsx` - `G节点权重及属性.xlsx`) are in the same directory.

2. Run the ` Task Driven Evaluation.py` file.

3. Check the output files to understand the results of each step.

## Notes

- Please ensure that the format and content of the data files meet the requirements of the code; otherwise, the program may encounter errors.

- The specific implementations of some functions (such as `calculate\_global\_efficiency`, `get\_info\_codes`, etc.) are omitted and need to be supplemented according to actual needs.