CSC0056 Homework 6

- Submit your work to Moodle before **9PM, Jan. 8th, Friday**. I will post the answer the same evening, for you to prepare for **the final exam on Jan. 11th**.
- Unlike the previous assignments, there's no empirical study section this time.

Table of Contents:

1. Review of Lecture Materials (70 points)

Review the lectures on Dec. 14th and Dec. 28th, and answer the following questions:

1. Dec. 14th lecture:
    1. **(15 points)** Describe what is *absolute time consistency*, why it is a useful notion, and what's the benefit of shedding inconsistent events in data communication intermediaries.
    2. **(10 points)** Describe the benefit of applying the following principles to assign the thread-level priority for a Mover:
        - For events of the same priority, the thread-level priority of the Mover should be lower than that of the Worker;
        - The thread-level priority of the Mover should be higher than that of the Worker working for events of a lower priority level.
2. Dec. 21th lecture:
    1. **(10 points)** In terms of system resource usage (e.g., CPU%), compare `"active replication"` (i.e., the state-machine approach) and `"passive replication"` (i.e., the primary-backup approach).
    2. **(15 points)** In the presence of using both passive replication and data retransmissions, give a qualitative analysis for the impact of a data publisher's inter-publish time on the system's capability of preventing data losses.
3. Dec. 28th lecture:
    1. **(10 points)** In terms of latency and data loss, compare the demand of file-transfer data flow and that of video-streaming data flow.
    2. **(10 points)** Can a window-based flow control protocol offer a minimum guaranteed data rate for a busy flow? If your answer is yes, explain; if your answer is no, explain.

2. Literature Reading (30 points)

Following Homework 5, now we will finish our study of the following paper:

> C. Wang, C. Gill and C. Lu, "Adaptive Data Replication in Real-Time Reliable Edge Computing for Internet of Things," *2020 IEEE/ACM Fifth International Conference on Internet-of-Things Design and Implementation (IoTDI)*, Sydney, Australia, 2020, pp. 128-134, doi: https://doi.org/10.1109/IoTDI49375.2020.00019.

Reading Sections III and IV of the above paper, and answer the following questions in your own words:

1. (**10 points**) Now you may see that the research work described in that paper can be thought of as an improvement over the work discussed during the Dec. 21th lecture. Describe the major difference you found between the work here and the one discussed in class (cited below).

   > C. Wang, C. Gill and C. Lu, "FRAME: Fault Tolerant and Real-Time Messaging for Edge Computing," *2019 IEEE 39th International Conference on Distributed Computing Systems (ICDCS)*, Dallas, TX, USA, 2019, pp. 976-985, doi: https://doi.org/10.1109/ICDCS.2019.00101.

2. (**10 points**) Give a reason that, in Step 3 of the adaptive data replication strategy, why does the system need to clear the mark made in Step 1?

3. (**10 points**) Give a reason why configuration `ARREC_all` actually saved more network bandwidth than configuration `ARREC_Li` did (Fig. 8).