IERG 4330/ ESTR4316 /IEMS 5730 Spring 2022
Homework 4

Release date: Mar 31, 2022
Due date: 23:59:00, Apr 19, 2022
The solution will be posted right after the deadline, so no late homework will be accepted!

Every Student MUST include the following statement, together with his/her signature in the submitted homework.

I declare that the assignment submitted on Blackboard system is original except for source material explicitly acknowledged, and that thea same or related material has not been previously submitted for another course. I also acknowledge that I am aware of University policy and regulations on honesty in academic work, and of the disciplinary guidelines and procedures applicable to breaches of such policy and regulations, as contained in the website http://www.cuhk.edu.hk/policy/academichonesty/.

Signed (Student Jerry) Date: 19-4-22

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Submission notice:

- Submit your homework via the elearning system

General homework policies:

A student may discuss the problems with others. However, the work a student turns in must be created COMPLETELY by oneself ALONE. A student may not share ANY written work or pictures, nor may one copy answers from any source other than one's own brain.

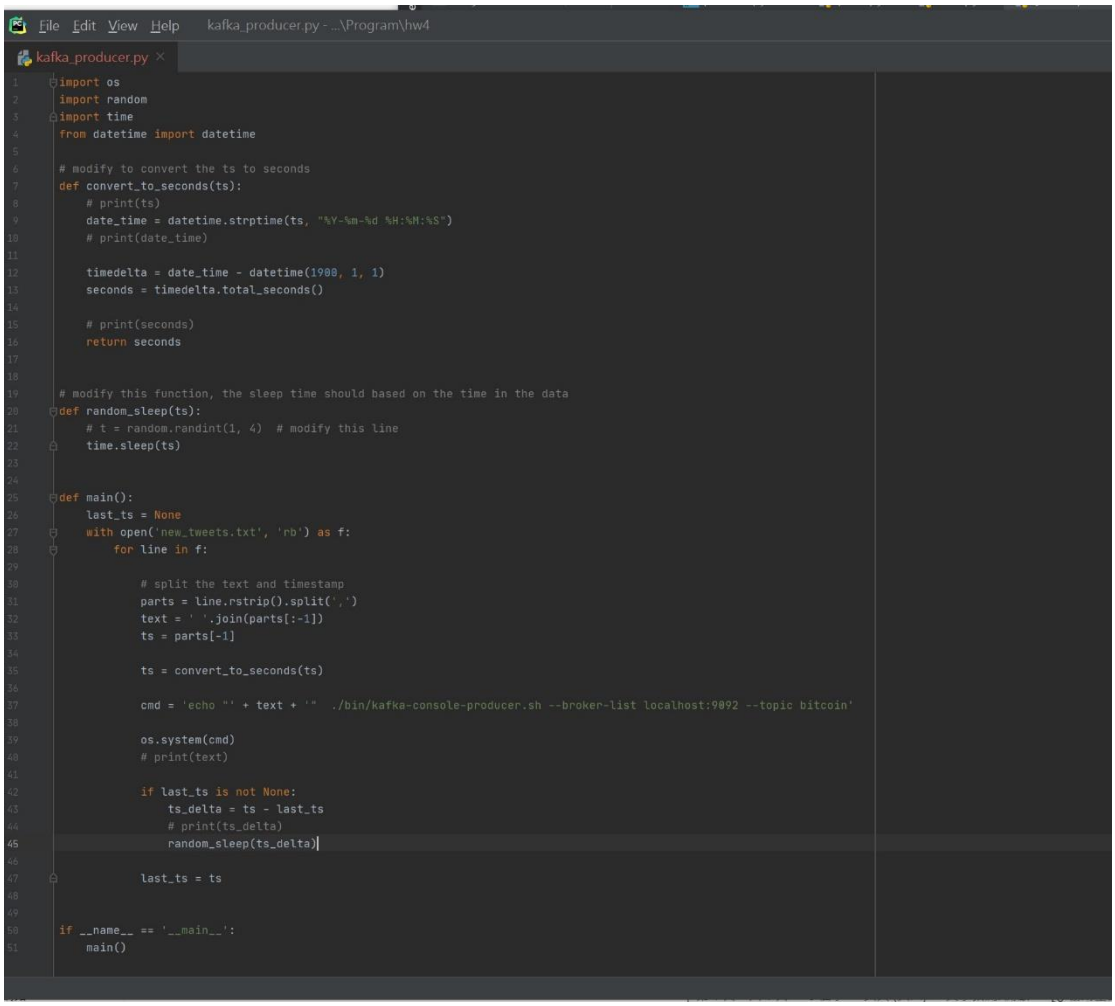
Each student **MUST LIST** on the homework paper the **name of every person he/she has discussed or worked with**. If the answer includes content from any other source, the student **MUST STATE THE SOURCE**. Failure to do so is cheating and will result in sanctions. Copying answers from someone else is cheating even if one lists their name(s) on the homework.

If there is information you need to solve a problem but the information is not stated in the problem, try to find the data somewhere. If you cannot find it, state what data you need, make a reasonable estimate of its value and justify any assumptions you make. You will be graded not only on whether your answer is correct but also on whether you have done an intelligent analysis.

Q2:

i)

The Kafka producer:



ii)

Output:

```
Showing 4096 bytes. Click here for full log
(u'#socialmedia', 2), (u'#xrp', 2), (u'#EarnOnLatoken', 1), (u'#linkedin', 1), (u'#government.', 1), (u'#medium', 1), (u'#gifts\u
---------- 2022-04-18 17:27:00 -----------
[(u'#TRON', 7), (u'#btc', 4), (u'#BitcoinTo', 4), (u'#cryptocurrency', 3), (u'#crypto', 3), (u'#twitter', 2), (u'#BTC', 2), (u'#N
---------- 2022-04-18 17:29:00 -----------
[(u'#TRON', 7), (u'#cryptocurrency', 3), (u'#Miami!Fabiano', 3), (u'#Bitcoin2021', 3), (u'#btc', 2), (u'#BTC', 2), (u'#NFT', 2),
---------- 2022-04-18 17:31:00 -----------
[(u'#BTC', 5), (u'#Miami!Fabiano', 5), (u'#Bitcoin2021', 5), (u'#BitcoinTo', 4), (u'#TRON', 3), (u'#NFT', 2), (u'#trading', 2), (
---------- 2022-04-18 17:33:00 -----------
[(u'#BitcoinTo', 6), (u'#BTC', 5), (u'#TRON', 5), (u'#Miami!Fabiano', 4), (u'#Bitcoin2021', 4), (u'#BitcoinHoping', 3), (u'#LMCHB
---------- 2022-04-18 17:35:00 -----------
[(u'#BitcoinTo', 5), (u'#TRON', 5), (u'#BitcoinHoping', 4), (u'#BTC', 2), (u'#btc', 2), (u'#electroneum', 1), (u'#DCA', 1), (u'#C
---------- 2022-04-18 17:37:00 -----------
[(u'#BitcoinHoping', 4), (u'#BitcoinTo', 4), (u'#btc', 3), (u'#TRON', 3), (u'#1SG', 2), (u'#Ethereum', 2), (u'#LatokenApp', 2), (
```

Code:

```
from pyspark.streaming.kafka import KafkaUtils
from pyspark import SparkConf, SparkContext
from pyspark.streaming import StreamingContext
from pyspark.sql import Row, SQLContext
import sys
import json
import time

def process_rdd(time, rdd):
  print("---------- %s ----------" % str(time))
  try:
    print(rdd.top(10, key=lambda x: x[1]))
  except:
    e = sys.exc_info()
    print("Error: ", e)

if __name__ == '__main__':
  sc = SparkContext(appName="test")
  sc.setLogLevel("WARN")

  ssc = StreamingContext(sc, 10)
  ssc.checkpoint('./checkpoint')
  kafkaStream = KafkaUtils.createStream(ssc, 'dicvmd7.ie.cuhk.edu.hk:2181', 'test', {'983-test': 1})

  words = kafkaStream.flatMap(lambda x: x[1].split()).filter(lambda x: x.startswith("#") and x[1:].lower() != "bitcoin" and len(x) > 1).map(lambda x: (x,1)).reduceByKeyAndWindow(lambda x, y: x + y, lambda x, y: x - y, 300, 120)
  words.foreachRDD(process_rdd)

  ssc.start()
  ssc.awaitTermination()
```

Q3

The producer is the same as in q2

Code:

```python
from pyspark.streaming.kafka import KafkaUtils
from pyspark import SparkConf, SparkContext
from pyspark.streaming import StreamingContext
from pyspark.sql import Row, SQLContext
import sys
import json
import time

from pyspark.sql import SparkSession
from pyspark.sql.functions import explode
from pyspark.sql.functions import split
from pyspark.sql import functions as F
from pyspark.sql.functions import window
from pyspark.sql.functions import size


if __name__ == "__main__":

    spark = SparkSession \
        .builder \
        .appName("Q3_t") \
        .getOrCreate()

    lines = spark \
      .readStream \
      .format("kafka") \
      .option("kafka.bootstrap.servers", "dicvmd7.ie.cuhk.edu.hk:6667") \
      .option("subscribe", '983-ft') \
      .load()

    # print(lines.isStreaming())
    # lines.isStreaming()

    words = lines.select(
       explode(
        split(lines.value, " ")
       ).alias("word"), "timestamp"
    )


    wordCounts = words.select("*")\
    .filter(words.word.startswith("#")) \
    .withWatermark("timestamp", "2 minutes") \
    .groupBy(
        window("timestamp", "10 minutes", "5 minutes"),
        "word") \
    .count().sort(F.col("count").desc())


    query = wordCounts \
    .writeStream \
    .option("checkpointLocation", "./checkpoint") \
    .outputMode("complete") \
    .format("console") \
    .start()


    query.awaitTermination()
```

Output:

```
-------------------------------------------
Batch: 4360
-------------------------------------------
+--------------------+--------------------+-----+
|              window|                word|count|
+--------------------+--------------------+-----+
|[1970-01-01 08:00...|                 |  126|
|                [,]|                    |  115|
|                [,]|          |  111|
|                [,]|                    |   87|
|[1970-11-02 18:04...|           |   82|
|                [,]|                |   79|
|[1970-11-02 18:04...|  ...|   78|
|                [,]|                |   75|
|[1970-01-01 08:00...|                 |   74|
|[1970-01-01 08:00...|                 |   66|
|                [,]|  ...|   63|
|[1970-11-02 18:04...|  ...|   58|
|                [,]|  ...|   55|
|[1970-11-02 18:04...|  6...|   54|
|                [,]|  Y...|   51|
|[1970-11-02 18:04...|  '...|   50|
|                [,]|          |   47|
|[1970-11-02 18:04...|  E...|   46|
|                [,]|  ...|   43|
|[1970-01-01 08:00...|                 |   42|
+--------------------+--------------------+-----+
only showing top 20 rows
```