



ISOM3370: Big Data Technologies Spring 2021

Class Meetings	Tuesday Thursday 12:00PM-01:20PM
Prerequisites	(ISOM 3230 or ISOM 3320 or ISOM 3400) and ISOM3360
Instructor	Yi Yang Email: imyiyang@ust.hk Begin subject: [ISOM3370]... Office Hours: By appointment
Teaching Assistant	Samuel Lai Email: imsamuel@ust.hk Office Hours: By appointment

Zoom: Room ID (927 6766 0426) Passcode (200117)

<https://hkust.zoom.us/j/92767660426?pwd=Vy8xMndJMERV0Hk4WdN5L1c0Rm9UZz09>

1. Course Overview

Over the decades there has been an explosion of data. With diversified data provisions, such as large Internet sites, sensor networks, scientific experiments, and government records, the volume of data that we create and capture keeps increasing at an exponential rate. The off-the-shelf techniques and technologies that we already used to store and analyze data cannot work efficiently for large-scale data processing. The challenges arise especially in the context of data-intensive computing. We need to develop and create new techniques and technologies to excavate “Big Data” and benefit our specified purposes.

The emergence of large distributed clusters enables data storage and computation to be distributed across thousands of commodity machines in data centers. One key breakthrough that makes this possible is the development of abstractions and frameworks that allow us to reason about computations at a massive scale, while hiding low-level details such as data movement, synchronization, and fault tolerance. Such disruptive technologies have become important data processing platforms for a variety of applications, and have transformed business, science, and many aspects of our society.

This course will introduce big data technologies, starting with MapReduce, which is the first of these datacenter-scale computation abstractions and whose Hadoop implementation lies at the core of an application stack that is gaining widespread adoption in both industry and academia. Because of the success of Hadoop, a large number of big data tools, with specialization ranging from cluster resource management to complex data analytics, were built on and around

Hadoop, creating a complete big data application stack. We will then cover some of the tools in this stack, such as Hive and Spark. The course will cover some widely used distributed algorithms in academia and industry. Some basics of programming languages, such as Python, will also be covered to help you understand algorithms and run them on massive datasets.

2. Prerequisites

ISOM 3230 or ISOM 3320 or ISOM 3400 and ISOM 3360

Knowledge of Python programming, database and data mining is required.

3. Lecture Notes and Readings

All courses materials (Lecture slides, assignments, and lab handouts) are available on the course website Canvas. Please check the course website frequently for updates.

4. Grading Policy

Your grades will be determined based on class and lab participation, homework assignments, the midterm and final exam, and group project.

Class and Lab Participation	10%
Lab and Homework Assignments	30%
Midterm Exam	25%
Final Exam	35%

Homework Assignment

There will be a total of **3 individual homework assignments**, each comprising questions to be answered and hands-on tasks. Completed assignments must be handed in via Canvas prior to the start of the class on the due date. Assignments will be graded and returned promptly.

Turn in your assignment early if there is any uncertainty about your ability to turn it in on the due date. Assignments up to 24 hours late will have their grade reduced by 25%; assignments up to one week late will have their grade reduced by 50%. After one week, late assignments will receive no credit.

Lab Session

This is primarily a lecture-based course, but lab participation is an essential part of the learning process in the form of active practice. You are NOT going to learn without practicing the big data technologies yourselves. During the lab session, I will expect you to be entirely devoted to the class by following the instructions. You will bring and use your own laptop to the class. For each lab, you need to finish and submit a report, even if you may not finish the lab in class. For the first 3 lab sessions, you are expected to submit a lab report. For the last 2 lab sessions, lab report is in the form of the homework assignment.

Exams

This course will have two exams. The midterm exam will test issues covered in the first half of the course. The final exam will cover the classes in the second half of the course. Review sessions will be scheduled to help you prepare for these examinations.

The midterm exam is tentatively scheduled on **Mar 18 25 in-class**. The final exam will be held during the final examination period; the date will be announced later in the semester.

Make-up exam policy: https://arr.ust.hk/reg/em/em_std_reg/reg_makeup.html

To quote, "If students wish the University to take into account illness or some other extenuating circumstances that have affected their performance in an examination, or ability to attend an examination, or to complete other assessment activities, they must report the circumstances of the case in writing and provide appropriate documentation to ARR, Academic Registry within one week of the scheduled date of the assessment activity. The Academic Registrar will review the case and make a recommendation to the relevant Dean, the Dean's designate or the Director of IPO."

Academic Integrity

Students at HKUST are expected to observe the Academic Honor Code at all times (see <http://acadreg.ust.hk/generalreg.html> for more information). Zero tolerance is shown to those who are caught cheating on any quiz or exam. In addition to receiving a zero mark on the quiz or exam involved, the final course grade will appear on your record with an X, to show that the grade resulted from cheating. This X grade will stay with your record until graduation. If you receive another X grade, you will be dismissed from HKUST.

Schedule of Lectures and Labs (subject to change)

Week	Date	Topics	Remarks
1	Feb 2	Course Introduction	
	Feb 4	Introduction to Hadoop and HDFS	
2	Feb 9	Hadoop Distributed File System	

	Feb 11	AWS and Linux Commands	Lab 1 out
3	Feb 16	Lab: Introduction to AWS	Lab 2 out
	Feb 18	Lab: Hadoop Distributed File System	
4	Feb 23	MapReduce	Homework 1 out
	Feb 25	MapReduce Continued	Lab 3 out
5	Mar 2	Lab: Running Hadoop MapReduce Job	
	Mar 4	MapReduce for Web Search	
6	Mar 9	Hive	
	Mar 11	Guest Speaker	
7	Mar 16	Hive Continued	
	Mar 18	Midterm Review	
8	Mar 23	Midterm Q&A session	
	Mar 25	Class Cancelled for Midterm Exam	
9	Mar 30	Spark Introduction	
	Apr 1	Spark RDD Programming	Lab 4 & Homework 2 out
10	Apr 6	Lab: Spark Programming	
	Apr 8	[no class] Study break	
11	Apr 13	[no class] Public Holiday	
	Apr 15	Spark Programming Continued	
12	Apr 20	Large-scale Machine Learning	
	Apr 22	Spark for Machine Learning MLlib	
13	Apr 27	Spark for Machine Learning MLlib Continued	Lab 5 & Homework 3 out
	Apr 29	Lab: Spark MLlib	
14	May 4	Find Similar Items in Massive Data	
	May 6	Final Exam Review	