HMGT 6325 & OPRE 6325:
Healthcare Operations Management
(Check eLearning for the latest version)

Course number:	HMGT 6325.501 & OPRE 6325.501
Pre-requisites:	Please refer to coursebook.utdallas.edu
Meeting time:	Wednesday 7:00 pm - 9:45 pm
Meeting place:	JSOM 1.117
Instructor:	Professor Wang (Guihua.Wang@UTDallas.edu)
Instruction Mode:	Traditional
Office Hour:	Thursday 4:00 pm – 5:00 pm
Location:	Microsoft Teams[1]
Teaching Assistant:	Mehdi Taher (Mehdi.Taher@UTDallas.edu)
Office Hour:	Tuesday 4:00 pm – 6:00 pm
Location:	JSOM 14.211[2]

ABOUT THE INSTRUCTOR:

Professor Wang is a faculty member of Operations Management at the Naveen Jindal School of Management, The University of Texas at Dallas. He obtained his PhD from the University of Michigan – Ann Arbor, MSc from the Georgia Institute of Technology, MSc and BEng from the National University of Singapore. Prior to his PhD study, Professor Wang worked as a supervisor of the industrial engineering department at United Parcel Service Asia headquartered in Singapore. Professor Wang's research focuses on the intersection of empirical econometrics and machine learning with application to personalized healthcare. More specifically, Professor Wang has developed new causal machine learning techniques such as the instrumental variable forest, the first-difference causal forest, and the multi-treatment forest for heterogeneous treatment effect analyses using observational healthcare data.

Professor Wang has published 15 peer-reviewed articles in *Management Science, Manufacturing & Service Operations Management, Production and Operations Management, Advances in Applied Probability, Transportation Research Part C, Surgery, Annals of Thoracic Surgery, Management and Business Review, and International Journal of Logistics Systems and Management*. His research has been covered by *Associated Press, Austin' NPR Station - KUT, Crain's Detroit, Financial Times, Fredericksburg Free Lance-Star, Go Dan River, Hickory Daily Record, Houston Chronicle, INFORMS Newsroom, JSOM Management Magazine, KULR 8, Lynchburg News and Advance, McDowell News, Medical Xpress, Medium, Michigan News, Montana Standard, National Affair, National Interest, North Platte, Opelika-Auburn News, Patch, Public Radio International, Quad-Cities Online, Roanoke Times, Science Daily, Simply Flying, Statesville Record & Landmark, Texas McCombs, The Conversation, UTD News Center, Yahoo! News*.

Professor Wang was the winner of the Chelliah Sriskandarajah Early Career Research Accomplishments Award, the winner of the Conference on Health IT and Analytics (CHITA) Best

[1] Please email the professor if you would like to meet in person.
[2] Please email the TA if you would like to meet via Teams.

Paper Award, the winner (twice) of the INFORMS Health Applications Society Student Paper Competition, a runner-up of the POMS College of Healthcare Operations Management Best Paper Award, a runner-up of the INFORMS Service Section Best Cluster Paper Competition, a runner-up of the POMS College of Service Operations Management Best Student Paper Award, a finalist of the POMS College of Operational Excellence Junior Scholar Best Paper Competition, a finalist of the MSOM Service Management SIG Best Paper Award, a finalist of the INFORMS Health Applications Society Pierskalla Best Paper Award, a finalist (twice) of the MSOM Student Paper Competition, a finalist (three times) of the INFORMS Service Science Best Student Paper Award Competition, and a finalist of the INFORMS Service Science Best Cluster Paper Award Competition.

COURSE DESCRIPTION:

Operations Management studies the design and management of the processes that transform inputs into finished goods or services. Operations are one of the primary functions of any organization. This course teaches various ways and means to improve healthcare operations, specifically focusing on using analytical methods and techniques to improve healthcare processes. Topics include reducing patient wait times, measuring productivity, streamlining process flows, tracking outcomes and performance metrics, and improving health management processes. The level of analysis varies considerably, from operations strategy to daily control of business processes. The objective of this course is to assist students in building the skills necessary to participate actively in decision-making involving healthcare management issues.

STUDENT LEARNING OBJECTIVES:

The student should be able to determine performance measures of manufacturing/service processes/systems in key operational dimensions. The student should also know what factors affect these measures, how these measures can be calculated and how these measures can be improved. More specific objectives are as follows:

- Describe and explain services, manufacturing, just in time, and total quality management strategies.
- Derive and compute optimal decisions, and performance measures such as costs and profits.
- Develop analytical thinking in operations practices.

CAHME DOMAINS AND COMPETENCY MAPPING:

HMGT 6325 HEALTHCARE OPERATIONS MANAGEMENT								
Program Goals	**PSLO**	**CSLO**	**Domain**	**Domain Name**	**Competency**	**Measure**	**How to Measure**	**Higher Level Learning**
Are prepared to be skilled decision-makers through comprehensive analysis of internal and external factors in healthcare environments. (PSLO 4)	Analyze how healthcare organizaitons create sustainable strategies to stay competitive	Describe and explain services, manufacturing, just in time, and total quality management strategies	1	Communication and Relationship Management	Present data analysis results to decision makers	Able to simplify analysis and recommendations for decision-makers	Group Project	No
Are prepared to be skilled decision-makers through comprehensive analysis of internal and external factors in healthcare environments. (PSLO 4)	Analyze how healthcare organizaitons create sustainable strategies to stay competitive	Derive and compute optimal decisions, and performance measures such as costs and profits	2	Leadership	Critically analyze organizational issues after a review of the evidence	Use systems-thinking and analytic methods to assess operations performance and improve organization processes	Homework Assignments and Tests; Process Improvement; Performance Evaluation	Yes
Are prepared to be skilled decision-makers through comprehensive analysis of internal and external factors in healthcare environments. (PSLO 4)	Analyze how healthcare organizaitons create sustainable strategies to stay competitive	Develop analytical thinking in operations practices	5	Business Knowledge and Skills	Demonstrate critical thinking and analysis	Understand the importance of crtiical thinking decision-making	Linear Programing & Inventory Mgmt	Yes
Are prepared to be skilled decision-makers through comprehensive analysis of internal and external factors in healthcare environments. (PSLO 4)	Analyze how healthcare organizaitons create sustainable strategies to stay competitive	Describe and model key supply chain processes, participants' roles, procedures, tools, technology, information systems, operational considerations, analytics, and best practices in healthcare setting	5	Business Knowledge and Skills	Outcomes and Measures	Develop a schedule, budget, and goals for a project and manage project resources to meet goals.	Homework Assignments and Tests: Queueing Theory and Quality Evaluation	Yes

Domain 1: Communication and Relationship Management

- Present data analysis results to decision makers (course coverage: healthcare analytics, group project)

Domain 2: Leadership

- Critically analyze organizational issues after a review of the evidence (course coverage: process flow analysis)

Domain 5: Business Knowledge and Skills

- Demonstrate critical thinking and analysis (course coverage: inventory management, linear programming)
- Outcomes measure and management (course coverage: queueing theory, quality control)

COURSE RESOURCES:

Course Notes:
Before each lecture, a PDF version of the slides will be posted on eLearning. Most of the time, these slides will be incomplete, and you will be expected to fill in the blanks in class. Partially completed slides will be posted within three days after the end of each class.

Assignments and Solutions:
Homework assignments will be posted at least three days before their due date. Solutions will be posted within one week after a homework assignment is graded.

Practice Problems:
Practice problems and solutions will be made available before the tests.

Grades:
Grades on assignments and tests will be posted on eLearning.

GRADING:

The course grades will be assigned based on the following points,

Category	**Weight**
Participation	5%
Homework	20%
Group Project	15%
Test 1	30%
Test 2	30%

Your final letter grade will be determined relative to your classmates.

Participation
Class participation is required. A portion of the grade for this course is directly tied to your participation, which may include engaging in group activities or others that solicit your feedback on questions, readings, or materials covered in the lectures. Students who fail to participate in class regularly are inviting scholastic difficulty. Using phones, laptops, or tablets for non-class-related

activities or eating snacks is strictly prohibited and regarded as class disruption. Class participation and disruption are documented by faculty.

Successful participation is defined as consistently adhering to University requirements, as presented in this syllabus. Failure to comply with these University requirements violates the Student Code of Conduct (https://policy.utdallas.edu/utdsp5003). Particularly, you are expected to go through the required materials before the corresponding session (see the Course Outline for details). You are expected to participate in class discussions actively. You are responsible for all material discussed and all course schedule changes announced during class.

Homework

Homework assignments are to be done individually. You need to download them from eLearning, write your answers, (scan if necessary) and upload your answers to eLearning. The due dates for homework are always 11:59 pm on the next Tuesday. **One point deduction per minute for late submission under any circumstance**. The lowest assignment score will be dropped.

Please follow these conventions when submitting homework assignments: (1) use either pdf or Word, (2) name the documents as <Homework#>_<Name>.docx or <Homework#>_<Name>.pdf (e.g., Homework1_FirstName_LastName.pdf), and (3) arrange the pages in sequence.

Group Project

The purpose of the group project is for students to understand real-world healthcare issues and policies, apply techniques learned in this course, and present the results to stakeholders. Details about the topic and group formation will be announced in class. Each group will perform original data analyses, survey existing studies, or a combination of both. Peer evaluation will be conducted at the end of the course.

The group project has three deliverables:

- Project proposal (due 11:59 pm on 10/22) – Each group needs to submit one 1-2 pages proposal. The proposal should include the names and Net IDs of group members and the following components: (1) background and significance, (2) study design and methods, and (3, optional) preliminary results and implications.
- Final report (due 11:59 pm on 11/24) – Each group needs to submit a 3-5 pages final report. The report should include the names and Net IDs of group members and the following components: (1) introduction, (2) methodology, (3) results, and (4) discussion.
- Group presentation (in class on 11/20) – Each group needs to submit one deck of 15-25 minutes presentation slides (due 11:59 pm on 11/19). The slides should include the names and Net IDs of group members and the following components: (1) introduction, (2) methodology, (3) results, and (4) discussion.

Tests 1 and 2

Test 1 covers the materials from sessions 1-5. Test 2 covers sessions 6-9. There is no comprehensive exam. Both tests will be held in the classroom (closed book, allowed to bring one A4 size handwritten double-sided help sheet). Do remember to bring your calculator. Any electronics or communication among students during the tests is strictly prohibited.

No alternative test will be offered except in a medical emergency, which requires a medical certificate from a physician. Missing a test without the instructor's pre-authorization will result in a zero score and will not be given an alternative test.

Any concern regarding the grading of tests should be addressed to both your instructor and your TA no later than three days after the grade is posted. We will review all your test answers, which may lead to an increase or decrease in your final grade.

COURSE POLICIES:

- One point deduction per minute for late homework submission under any circumstance.
- **No** alternative test will be offered except in a medical emergency (certificate required).
- **No** extra credit work will be given under any circumstance.
- Academic dishonesty results in a zero score for the corresponding work. In particular, cheating on a homework assignment results in a zero score for the homework assignment; cheating on a test results in a zero score for the test.
- Course materials and resources may **not** be reproduced or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct (https://policy.utdallas.edu/utdsp5003).

UT DALLAS SYLLABUS POLICIES AND PROCEDURES:

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please go to http://go.utdallas.edu/syllabus-policies for these policies.

ACADEMIC SUPPORT RESOURCES:

See https://provost.utdallas.edu/syllabus-policies/#academic-support-resources for a list of the University's academic resources for all students.

STUDENT ACCESSIBILITY RESOURCES:

See https://studentaccess.utdallas.edu/ for a list of the University's academic resources for students with disabilities.

COVID-19 GUIDELINES AND RESOURCES:

See http://go.utdallas.edu/syllabus-policies for the University's COVID-19 resources.

COMET CREED:

The Comet creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same: "*As a Comet, I pledge honesty, integrity, and service in all that I do*."

TENTATIVE COURSE OUTLINE

Session	Date	Topic	Homework	Group Project
1	8/21	Introduction & Process Flow Analysis I	0 & 1	
2	8/28	Process Flow Analysis II	2	
3	9/4	Process Flow Analysis III	3	
4	9/11	Project Management	4	Self-enroll in a group
5	9/18	Inventory Management	5	
	9/25	Review Session I (Sessions 1 – 5)		
6	10/2	Queueing Theory	6	
7	10/9	Linear Programming	7	
	10/16	Test I (Sessions 1 – 5)		
	10/23	No Class: Conference		Proposal due 10/22
8	10/30	Healthcare Analytics	8	
9	11/6	Quality Control / Supply Chain	9	
	11/13	Review Session II (Sessions 6 – 9)		
	11/20	Student Presentation		
	11/27	No Class: Holiday		Report due 11/24
	12/4	Test II (Sessions 6 – 9)		

The descriptions and guidelines contained in this syllabus are subject to change at the discretion of the Professor. The latest version is available at eLearning.

OPTIONAL REFERENCE READING

All the material covered in the assignments and tests will be available on the slides. Below books are optional, although the first book is strongly recommended.

"Matching Supply with Demand: An Introduction to Operations Management" by Cachon, G. and C. Terwiesch. New York, NY: McGraw&Hill / Irwin, 3rd edition. ISBN: 978-0073525204.

"Healthcare Operations Management" by McLaughlin, B. and J. Olson. Chicago, IL: Health Administration Press, 3rd edition. ISBN: 978-1567938517.

"Fundamentals of Linear Optimization: A Hopefully Uplifting Treatment" by Topaloglu, H. The book is available at https://people.orie.cornell.edu/huseyin/lp_book.pdf.

"Health Care Supply Chain Management" by Ledlow, G., K. Manrodt, and D. Schott. Jones & Bartlett Learning, 1st edition. ISBN: 978-1284081855.

SESSION TOPIC	**OPTIONAL READING**
Introduction & Process Flow Analysis I	Cachon and Terwiesch 2.1, 2.2, 3.1, 3.2, 3.3
Process Flow Analysis II	Cachon and Terwiesch 3.4, 3.5, 4.1 to 4.4
Process Flow Analysis III	Cachon and Terwiesch 3.6, 7.1 to 7.3
Project Management	Cachon and Terwiesch 5.1 to 5.7
Inventory Management	Cachon and Terwiesch 2.3, 2.4, 7.6 and 7.7
Queueing Theory	Cachon and Terwiesch 8.1 to 8.6, 8.9
Linear Programming	Topaloglu Chapters 1-2
Healthcare Analytics	McLaughlin and Olson Chapter 7
Quality Control	Cachon and Terwiesch 10.1 to 10.5, Chapter 11
Supply Chain Management	Cachon and Terwiesch Chapter 17

STRATEGIES FOR SUCCESS

Workload Expectation

The key to success in this course is **PRACTICE**. You will be given the opportunity to work on many practice problems. The university guidelines specify that you study at least two hours per week for every credit hour you are enrolled. Because this course has three semester credit hours, you should spend **at least six hours** per week outside class: preparing for and reviewing class materials, solving homework assignments, working on group projects, and preparing for tests. Trimming this time input will diminish the value of the educational experience for everyone. Please recognize the importance of advance preparation, and begin now to level-load your course time input.

Class Preparation

The learning objectives, before-class preparations, and after-class activities appear below. In and after each class, you will be expected to:

a. Be completely up-to-date with the materials covered so far. A lot of the materials in this course build on materials taught earlier, so a significant recall will be involved.
b. Follow along with the professor as concepts are explained and examples are solved on paper as well as using software.
c. Ask questions, contribute to class discussions, and be prepared to answer questions posted by the professor.
d. After class, review the covered materials thoroughly and refer to the optional textbooks or additional readings if necessary.

I understand you have limited time. However, I strongly urge you to devote adequate time to the course because this is not the material you can cram over a day or two.

Homework

Because the weekly homework assignments are designed to improve your problem-solving skills further, they are usually more difficult than in-class examples and problems. I strongly encourage you to start working on these homework assignments early and submit them to eLearning on time. One point deduction per minute for late homework submission under any circumstance.

Group Project

You are strongly encouraged to actively participate and contribute to the group project, and submit the deliverables on time. Practice your presentation as many times as possible and be prepared to answer questions. Peer evaluation may be conducted at the end of the course.

Tests 1 and 2

Tests 1 and 2 will consist of quantitative questions related to the course materials and homework assignments. Practice problems and solutions will be provided to prepare you for the tests. The combination of course notes, homework assignments, and practice problems will fully prepare you to take the tests. Both tests will be held in the classroom. Students are responsible for making sure they appear for the tests on time. No alternative test will be offered except in a medical emergency.

How to Get Help

In addition to my office hours, your TA will hold additional office hours for those who need help. This course moves rapidly. **DO NOT FALL BEHIND**! It is recommended that you see your TA or your professor **immediately for any difficulties**.

DETAILED SESSION SCHEDULE (TENTATIVE)

A session-by-session outline of the entire course is provided below, where you will find the learning objectives, before-class preparations, and after-class activities for each session. I will attempt to follow this schedule as much as possible, although I reserve the right to modify the schedule depending on the evolution of the course. Details about the textbooks are provided in other parts of the syllabus.

SESSION 1 8/21

INTRODUCTION AND PROCESS FLOW ANALYSIS I

Learning Objectives:

- Understand process views of organizations
- Understand the difference between manufacture and service process
- Learn to draw a process flow diagram
- Learn to determine the capacity of a process

Preparation:

- Complete homework 0 and submit it to eLearning by 11:59 pm on Aug 27.
- Read optional textbooks: Cachon and Terwiesch 2.1, 2.2, 3.1, 3.2, 3.3.
- Watch optional video: Operations Management.

After Class:

- Complete homework 0 and 1 and submit them to eLearning by 11:59 pm on Aug 27.
- Read optional textbooks: Cachon and Terwiesch 3.4, 3.5, 4.1 to 4.4.

SESSION 2 8/28

PROCESS FLOW ANALYSIS II

Learning Objectives:

- Understand batch process
- Learn how to calculate setup time, batch size, and capacity with setup
- Understand the mismatch between capacity and demand
- Learn to calculate flow rate, utilization, and labor cost

Preparation:

- Read optional textbooks: Cachon and Terwiesch 3.4, 3.5, 4.1 to 4.4.
- Watch optional video: Shared Medical Appointments at Aravind Pondicherry.

After Class:

- Complete homework 2 and submit it to eLearning by 11:59 pm on Sep 3.
- Read optional textbooks: Cachon and Terwiesch 3.6, 7.1 to 7.3.

SESSION 3 9/4

PROCESS FLOW ANALYSIS III

Learning Objectives:

- Understand theoretical flow time versus actual flow time
- Learn to draw inventory dynamics
- Determine waiting time based on inventory dynamics
- Determine potential bottleneck from utilization profile

Preparation:

- Read optional textbooks: Cachon and Terwiesch 3.6, 7.1 to 7.3.

After Class:

- Complete homework 3 and submit it to eLearning by 11:59 pm on Sep 10.
- Read optional textbooks: Cachon and Terwiesch 5.1 to 5.7.
- Watch the optional videos: Project Network Diagrams and Project Acceleration.

SESSION 4 9/11

PROJECT MANAGEMENT

Learning Objectives:

- Represent a project with a network diagram
- Compute the project duration and determine the critical activities
- Reduce the duration of the project in an economical way
- Learn to deal with randomness

Preparation:

- Read optional textbooks: Cachon and Terwiesch 5.1 to 5.7.
- Watch the optional videos: Project Network Diagrams and Project Acceleration.

After Class:

- Complete homework 4 and submit it to eLearning by 11:59 pm on Sep 17.
- Self-enroll in a group project at eLearning by 11:59 pm on Sep 17.
- Read optional textbooks: Cachon and Terwiesch 2.3, 2.4, 7.6, and 7.7.

SESSION 5 9/18

INVENTORY MANAGEMENT

Learning Objectives:

- Understand holding cost and fixed cost
- Learn to calculate optimal order quantity (EOQ)
- Learn to calculate lead time and reorder-point
- Learn to calculate reorder-point under random demand
- Learn to calculate economic production quality (EPQ)

Preparation:

- Read optional textbooks: Cachon and Terwiesch 2.3, 2.4, 7.6, and 7.7.

After Class:

- Complete homework 5 and submit it to eLearning by 11:59 pm on Sep 24.
- Prepare for test 1 by reviewing sessions 1-5 lecture notes, homework, and practice problems.

REVIEW SESSION I 9/25

Learning Objectives:

- Review the materials from sessions 1-5
- Go through practice problems for test 1

Preparation:

- Prepare for test 1 by reviewing sessions 1-5 lecture notes, homework, and practice problems.

After Class:

- Read optional textbooks: Cachon and Terwiesch 8.1 to 8.6, 8.9.
- Read the optional article: The Poisson Distribution and Poisson Process Explained.
- Prepare for test 1 by reviewing sessions 1-5 lecture notes, homework, and practice problems.

SESSION 6 10/2
QUEUEING THEORY

Learning Objectives:

- Understand variability causes queues
- Learn process performance measures
- Learn Little's Law and its applications
- Solve waiting problems in practice

Preparation:

- Read optional textbooks: Cachon and Terwiesch 8.1 to 8.6, 8.9.
- Read the optional article: The Poisson Distribution and Poisson Process Explained.

After Class:

- Complete homework 6 and submit it to eLearning by 11:59 pm on Oct 8.
- Read optional textbooks: Topaloglu Chapters 1-2.
- Install the Solver Add-in by reading the instruction and watching the video.

SESSION 7 10/9
LINEAR PROGRAMMING

Learning Objectives:

- Identify decision variables
- Learn to write the objective function and constraints
- Understand optimal solution and feasible solutions
- Learn to solve a linear programming (LP) problem graphically
- Learn to use Excel Solver to solve an LP problem

Preparation:

- Read optional textbooks: Topaloglu Chapters 1-2.
- Install the Solver Add-in by reading instruction and watching video.
- Bring your laptop with the Solver Add-in to the class.

After Class:

- Prepare for test 1 by reviewing sessions 1-5 lecture notes, homework, and practice problems.
- Complete homework 7 and submit it to eLearning by 11:59 pm on Oct 15.
- Submit a group project proposal to eLearning by 11:59 pm on Oct 22.
- Read optional textbooks: McLaughlin and Olson Chapter 7.

TEST 1 10/16

Test 1 will be held in the classroom from 7:00-9:00 pm on Oct 16th. It covers the materials from sessions 1-5. The test is closed-book and closed-note, but you are allowed to bring one A4 size handwritten double-sided help sheet. Do remember to bring your calculator. Any electronics or communication among students during the test is strictly prohibited.

SESSION 8 10/30

HEALTHCARE ANALYTICS

Learning Objectives:

- Learn simple linear regression model
- Learn to use Excel to solve a regression problem
- Learn multiple regression model
- Understand the general linear model

Preparation:

- Read optional textbooks: McLaughlin and Olson Chapter 7.
- Install the Analysis ToolPak in Excel by reading the instruction and watching the video.
- Bring your laptop with the Analysis ToolPak to the class.

After Class:

- Complete homework 8 and submit it to eLearning by 11:59 pm on Nov 5.
- Read optional textbooks: Cachon and Terwiesch 10.1 to 10.5, Chapters 11 and 17.

SESSION 9 11/6

QUALITY CONTROL / SUPPLY CHAIN

Learning Objectives:

- Understand variability in quality
- Determine whether a process is in control
- Measure a process' performance in quality
- Understand the bullwhip effect in supply chain

Preparation:

- Read optional textbooks: Cachon and Terwiesch 10.1 to 10.5, Chapters 11 and 17.

After Class:

- Complete homework 9 and submit it to eLearning by 11:59 pm on Nov 12.
- Prepare for test 2 by reviewing sessions 6-9 lecture notes, homework, and practice problems.

REVIEW SESSION II 11/13

Learning Objectives:

- Review the materials from sessions 6-9
- Go through practice problems for test 2

Preparation:

- Prepare for test 2 by reviewing sessions 6-9 lecture notes, homework, and practice problems.

After Class:

- Submit a deck of presentation slides to eLearning by 11:59 pm on Nov 19.
- Submit a group project final report to eLearning by 11:59 pm on Nov 24.
- Prepare for test 2 by reviewing sessions 6-9 lecture notes, homework, and practice problems.

STUDENT PRESENTATION 11/20

Each group will have 15-25 minutes for the presentation (including questions and answers). The presentation should include the following components: (1) introduction, (2) methodology, (3) results, and (4) discussion.

TEST 2 12/4

Test 2 will be held in the classroom from 7:00-9:00 pm on Dec 4th. It covers the materials from sessions 6-9. The test is closed-book and closed-note, but you are allowed to bring one A4 size handwritten double-sided help sheet. Do remember to bring your calculator. Any electronics or communication among students during the test is strictly prohibited.