

**Online Semi-Weekly virtual meeting TUESDAY and THURSDAY @10 AM PST vis Zoom  
(Zoom Meeting invitation link is announced on Canvas as well as provided in this syllabus)**

**Instructor:** Professor Yvonne Chueh

**Office:** SAMU 218 I (Tel: 963-2124)

**e-mail:** [chueh@cwu.edu](mailto:chueh@cwu.edu)

**Office hours:** by email appointments.

[www.cwu.edu/faculty/chueh](http://www.cwu.edu/faculty/chueh).

**Course Goals:** This sequence of courses, Math 418A(4 Credits), Math 418B(4 Credits), and Math 418C(4 Credits) is designed to provide students with an understanding of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in reserving, valuation, pricing, asset/liability management, investment income, capital budgeting, and valuing contingent cash flows. The third quarter will also include an introduction to financial instruments, including derivatives, and the concept of no-arbitrage as it relates to financial mathematics. The sequence is designed to prepare students for Exam FM offered by the Society of Actuaries; we will also cover some material that is on Exam IFM (Investment and Financial Markets).

**Prerequisite:** Math 418B.

**Reference Texts:** McDonald, Derivatives Markets, 3rd edition.

**Grading plan:**

- Attendance: self-assessment combined with Canvas Activities Records (50 points)
- Assignments posted on Canvas (200 points)
- Final Project Presentation, with written work or PPT slides (50 points)
- Final Project Written Report (50 points)

**Total: 300 points**

A perfect score on both of the above categories would result in a total of 500 points. Your course grade will be determined by the percentage  $p$  of these points you earn, according the following scale.

A (100-94%) A- (93-90%) B+ (89-87%) B (86-83%) B- (82-80%) C+ (79-77%)

C (76-73%) C- (72-70%) D+ (69-67%) D (66-63%) D- (62-60%) F (59-0%)

**Main Weekly Topics to learn and practice**

<b>Week 1</b>	<b>March 30~April 2</b>	<b>Intro to Derivatives</b>
<b>Week 2</b>	<b>April 5~9</b>	<b>Intro to Forwards and Futures</b>
<b>Week 3</b>	<b>April 12~16</b>	<b>Put-Call Parity</b>
<b>Week 4</b>	<b>April 19~23</b>	<b>Risk Neutral Valuation</b>
<b>Week 5</b>	<b>April 26~30</b>	<b>Intro to Options</b>

<b>Week 6</b>	<b>May 3~7</b>	<b>Comparing Options</b>
<b>Week 7</b>	<b>May 10~14</b>	<b>Research Break</b>
	<b>May 16~21</b>	<b>SOURCE DAY</b>
<b>Week 8</b>	<b>May 17~21</b>	<b>Research Project Report</b>
<b>Week 9</b>	<b>May 24~28</b>	<b>Binomial Pricing Model</b>
<b>Week 10</b>	<b>May 31~June 4</b>	<b>One-Period Binomial Tree; Arbitraging a Mispriced Option</b>
<b>Week 11</b>	<b>June 7~11</b>	<b>Final Exam Week</b>

The following Learning Objectives and Outcomes are excerpts from the SOA Exam IFM syllabus which are relevant to our weekly topics. Although not directly covered and tested in this class, they (learning objective and outcomes) serve as a good guidance for you to search out references for deepening your understanding and appreciation of the content to cover in this class. When time permits, additional supplemental reading material may be available and posted on Canvas; however, you are encouraged to find information to help you build background knowledge and fundamentals outside our lectures.

<b>6. Topic: Introductory Derivatives - Forwards and Futures (5-10%)</b>
<b>Learning Objectives</b>
The Candidate will understand how forward contracts and futures contracts can be used in conjunction with the underlying asset in a risk management context.
<b>Learning Outcomes</b>

The Candidate will be able to:

- a) Describe the characteristics and terms of the main derivatives instruments (including forwards and futures).
  - o Distinguish between long and short positions for both assets (including short selling of stocks) and derivatives on assets.
  - o Recognize the transaction costs affecting profit calculations for both assets and derivatives on assets (including commissions and bid-ask spread).
- b) Describe the characteristics and terms relating to both forward contracts and prepaid forward contracts.
  - o Define and recognize the following terms relating to the timing of stock purchases: outright purchase, fully leveraged purchase, prepaid forward contract, and forward contract.
  - o Determine payoffs and profits for both long and short positions on forward contracts.
  - o Calculate prices for both forward contracts and prepaid forward contracts on stocks with no dividends, continuous dividends, and discrete dividends.
  - o Construct a synthetic forward from the underlying stock and a risk-free asset and identify arbitrage opportunities when the synthetic forward price is different from the market forward price.
- c) Describe the characteristics and terms relating to both futures contracts and the associated margin accounts.
  - o Define and recognize the following terms relating to the mark-to-market process: Marking to market, margin balance, maintenance margin, and margin call.
  - o Evaluate an investor's margin balance based on changes in asset values.

## 7. Topic: General Properties of Options (10 -15 %)

### Learning Objectives

The Candidate will understand how call options and put options can be used in conjunction with the underlying asset in a risk management context.

### Learning Outcomes

The Candidate will be able to:

- a) Explain the cash flow characteristics and terms relating to various options.
  - 0 Define and recognize the following terms relating to option classification: call and put options, expiration date, strike price, moneyness, and option style.
  - 0 Calculate the payoff and profit on both long and short positions with respect to both call and put options.
  - 0 Calculate the payoffs on exotic options: Asian (arithmetic and geometric), barrier, compound, gap, and exchange.
  - 0 Calculate the payoffs on exotic options: lookback, chooser, shout, rainbow, and forward start.
- b) Apply option strategies in a risk management context.
  - 0 Recognize that a long put can be used as an insurance strategy for a long stock position and a long call can be used as an insurance strategy for a short stock position.
  - 0 Understand how the following option strategies can be used as tools to manage financial risk or speculate on price or volatility: option spreads (bull, bear, ratio), collar, straddle, strangle, and butterfly spread.
  - 0 Evaluate the payoff and profit of the option strategies described above.
- c) Explain the general properties of options that affect option prices.
  - 0 Apply put-call parity to European options on stocks with no dividends, stocks with continuous dividends, stocks with discrete dividends, currencies, and bonds.
  - 0 Compare options with respect to term-to-maturity and strike price.
  - 0 Identify factors affecting the early exercise of American options and the situations where the values of European and American options are the same.

## 8. Topic: Binomial Pricing Models (10%)

### Learning Objectives

The Candidate will understand how binomial trees can be used to approximate the prices of both European and American call and put options on various underlying assets.

### Learning Outcomes

The Candidate will be able to:

- a) Explain the concept of no arbitrage and the risk-neutral approach to valuing derivatives securities.
  - Understand the concept of no arbitrage when comparing actual and synthetic calls, or when comparing actual and synthetic puts.
  - Understand the concepts underlying the risk-neutral approach to valuing derivatives securities in the context of the Binomial Option Pricing Model.
- b) Use the Binomial Option Pricing Model to calculate the value of European and American call and put options, along with the value of Asian and barrier options.
  - Price options under a one-period binomial model on a stock with no dividends.
  - Extend the binomial model to multi-period settings for pricing both European and American call and put options.
  - Extend the binomial model to other underlying assets, including stock indices with continuous dividends, currencies, and futures contracts.

*A word of Wisdom: Early and clear communication is the key to your success in every class, including this one, besides your hard work, which is a GIVEN I assume from you. Please work with me and the classmates, talk to me if there is anything that you might need additional assistance. We are forming a learning community in Math 418C, and I am excited to see how the class can facilitate the completion of your spring course. Now let's do the work! By going through the documents on Canvas, then direct your questions to my way or post it on Canvas Discussions!*

**Other Information:** Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any barriers to learning, discuss your concerns with the instructor first. Students with disabilities should contact Disability Services to discuss a range of options to removing barriers, including accommodations. Call (509) 963-2214 or email [ds@cwu.edu](mailto:ds@cwu.edu) for more information.

I reserve the right to adjust policies in this syllabus if necessary during the quarter.

During the last week of class, you will have regular homework assignments due. We will be covering new material up to and possibly including the last day of class.