

United States International University Africa,

School of Science & Technology, Date: 24/06/2024 Time: 1100-1240

Department of Data Science & Analytics, Course: MTH3010A Mathematical Finance Semester: US2024 Lecturer: Joseph Owuor

Mid Semester Examination

Solve all problems while demonstrating each step clearly. The Exam is worth a total of 20 points.

- (3 pts) 1. Define sample space, measurable space and probability measure and give examples in each case. Explain their significance in mathematical finance.
- (3 pts) 2. Completely characterize a normal distribution. Explain in details the significance of a normal distribution in the pricing of options.
- (4 pts) 3. Simulate paths of Brownian motion and visualize them in Python. (choose your own parameters)
- (3 pts) 4. Give a detailed relationship between a martingale and a filtration. How are the two useful in mathematical finance?
- (3 pts) 5. Give the statement of Ito's lemma. Hence apply Ito's Lemma to $f(W_t, t) = W_t^2$.
- (4 pts) 6. Give a simulation of stock prices using Brownian motion in Python. Hence choose one of the parameters and explain the impact of varying it.