Prep Course

Module I Homework 4

Due 23:30, Saturday, August 3rd, 2024 (Chicago time)

For this Homework, you should submit a single PDF named: **M1HW4_LASTNAME_Firstname.pdf**

Problem 1

Please compute the following definite integral:

$$\int_0^2 \max(x, x^2)\, dx$$

Problem 2

Please compute the following indefinite integral:

$$\int x \cdot (\log x)^2 dx$$

Problem 3

Please compute the following:

$$\frac{d}{dx} x^{x^x}, where\ x > 0$$

Note that x^{x^x} should be understood as $x^{(x^x)}$ rather than $(x^x)^x$.

Problem 4

No justification or proof is required for this problem.

You've placed three coins in a jar: one normal, one double-headed, and one double-tailed.

Someone selects a coin uniformly at random from the jar and tosses it. If it comes up heads, which of the options below is the probability that the coin is normal?

a) $\frac{1}{3}$
b) $\frac{2}{3}$
c) $\frac{3}{4}$
d) $\frac{3}{5}$

Problem 5

No justification or proof is required for this problem.

A dance instructor is teaching a class of 5 boys and 5 girls, and she'd like to pair them up into boy-girl pairs. How many different ways can she do that?

a) 25
b) 20
c) 60
d) 120

Problem 6

Given the call and put pricing formulas given on slide 4 of Calculus lecture 1 and slide 3 of Calculus lecture 2, if we view both formulas as a function of σ with all other parameters fixed, please show that the call and the put share the same vega, i.e., please prove the following equality.

$$\frac{d}{d\sigma}C_0 = \frac{d}{d\sigma}P_0$$

(Hint: $N'(x) = N'(-x)$)