University of Macerata
Mathematical Methods for Economics and Finance

Exam

July 03, 2024

Surname:
Name:
Student number:

Please, save your work in Matlab in a **.txt** file entitled:

YourSurname_YourStudentNumber.txt

and send it to mauromaria.baldi@unimc.it by the end of the exam. In the body of the same email, please copy and paste your Matlab work.

Don't forget to write your surname, name and student number on each sheet you are submitting.

1. Let be given the following spot and forward rates of interests: $i(0,1) = 0.05$, $i(0,2) = 0.07$, and $i(0,2,3) = 0.06$. Determine $i(0,1,2)$ and $i(0,3)$.

2. In Matlab:

   (a) Save the 3×5 matrix A with:
      - first row: vector of equally spaced elements from 0 to 12
      - second row: all elements equal to 1
      - third row: equally spaced elements from 2 to -2

   (b) Save the number $b = \ln(2)$ and compute the scalar product between b and A thus obtaining B

   (c) Compute C by summing A and B

   (d) Compute $D = A - 2C + 1$

3. Consider the function $f(x, y) = \frac{x}{y-1}$. Sketch the domain of f and determine its level curves.

4. Consider the function $f(x, y) = x^3 + y^3 + 3xy$. Find its critical points and, if possible, classify them.

5. Consider the function $f(x, y) = xe^y + 1$. Find the second-degree Taylor polynomial centered at $\mathbf{x}_0 = (1, 0)$. Then, plot f along with the Taylor polynomial in Matlab.

6. Optional question: provide a sketch of the geometrical proof for a constrained maximization problem with two variables and one equality constraint.