CS 107 Pair Programming 7
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1 Exercise 1

We have matrix $f(x, y)$ as follows: $\begin{bmatrix} x^2 + y^2 \\ e^{x+y} \end{bmatrix}$

1.1 Part A

Our Jacobian is as follows:

$$\text{Jacobian} = \begin{bmatrix} 2x & 2y \\ e^{x+y} & e^{x+y} \end{bmatrix} \tag{1}$$

The Jacobian evaluated at $(1, 1)$ is

$$Jp = \begin{bmatrix} 2+2 \\ e^2 + e^2 \end{bmatrix} = \begin{bmatrix} 4 \\ 2e^2 \end{bmatrix} \tag{2}$$

1.2 Part B

i.)

The Jacobian evaluated at $(1, -2)$ is

$$Jp = \begin{bmatrix} 2-4 \\ e^{-1} - 2e^{-1} \end{bmatrix} = \begin{bmatrix} -2 \\ -e^{-1} \end{bmatrix} \tag{3}$$

ii.)

The Jacobian evaluated at $(1, 1)$ is

$$Jp = \begin{bmatrix} 4 \\ 2e^2 \end{bmatrix} \tag{4}$$

1.3 Part C

trace	elem.	val.	elem der	Δ_x	Δ_y
x_1	x_1	1	$\dot{x_1}$	1	1
x_2	x_2	1	$\dot{x_2}$	-2	1
v_1	x_1^2	1	$2x_1\dot{x_1}$	2	2
v_2	x_2^2	1	$2x_2\dot{x_2}$	-4	2
v_3	$v_1 + v_2$	2	$\dot{v_1} + \dot{v_2}$	-2	4
v_4	$x_1 + x_2$	2	$\dot{x_1} + \dot{x_2}$	-1	2
v_5	e^{v_4}	e^2	$e^{v^4}\dot{v^4}$	$-e^{-1}$	$2e^2$

Table 1: Evaluation trace of Part B