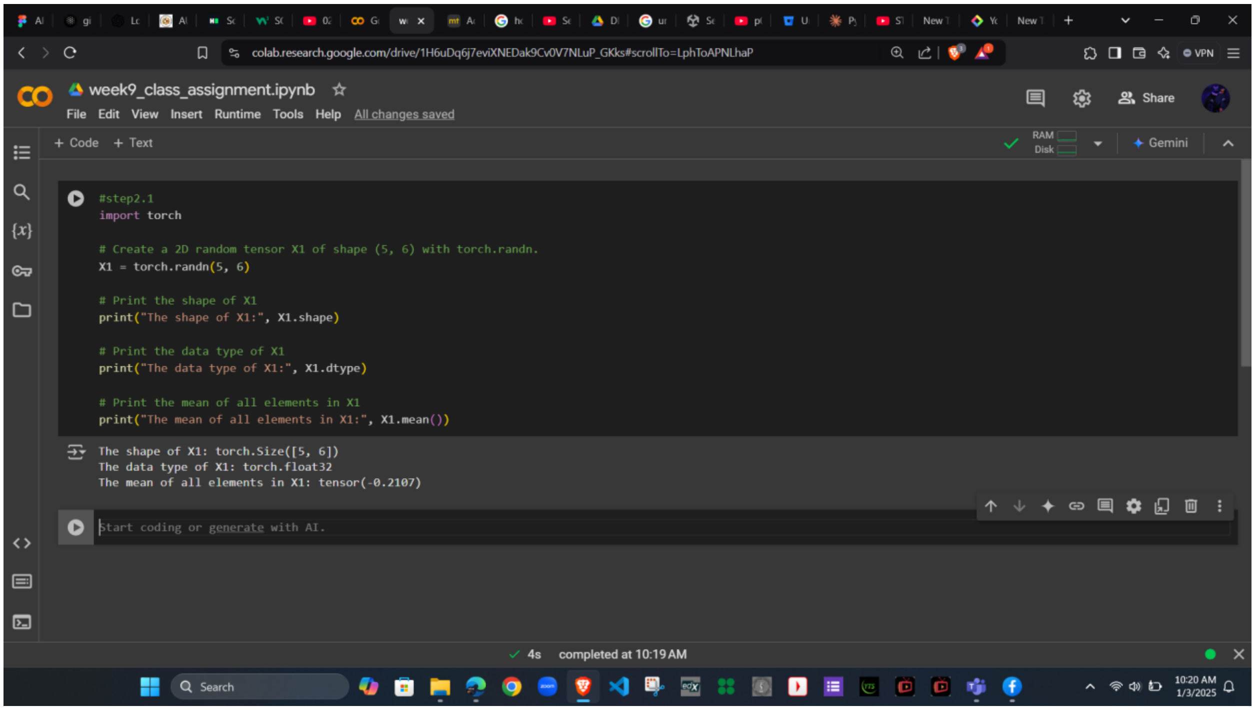
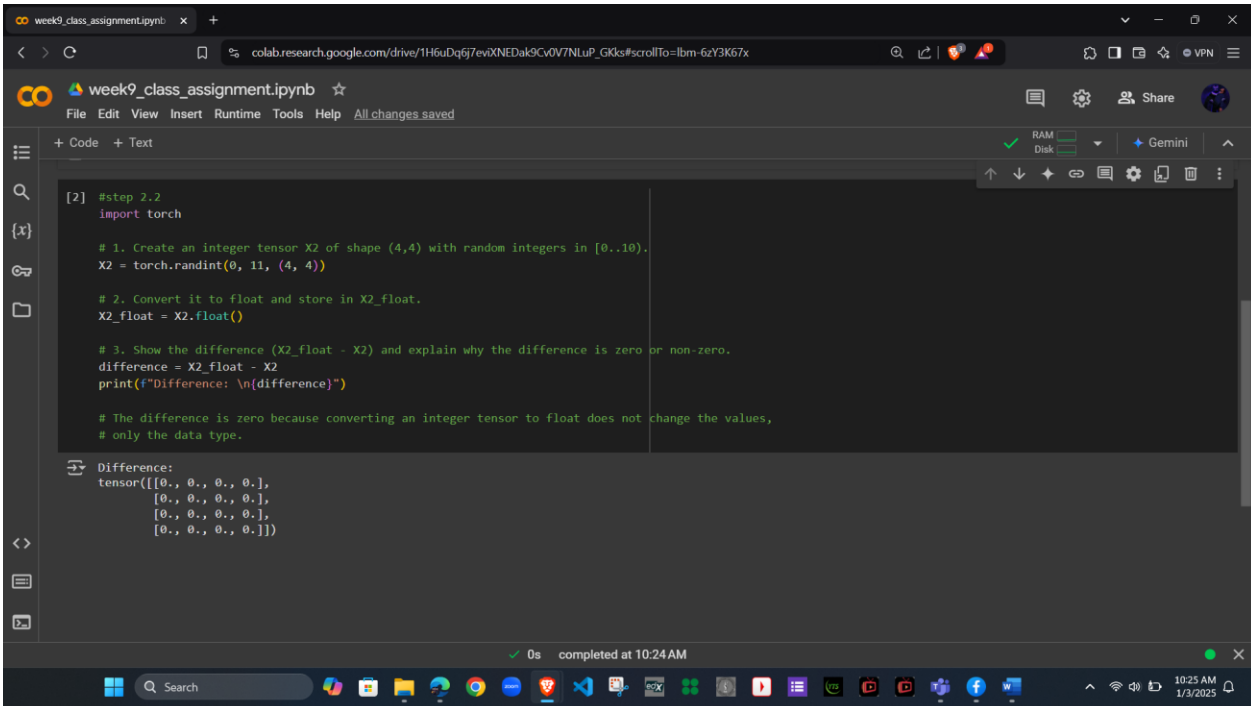
Part 1: Basic Pytorch

Step 2.1 :



Step 2.2: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[2]
#step 2.2
import torch
# 1. Create an integer tensor X2 of shape (4,4) with random integers in [0..10).
X2 = torch.randint(0, 11, (4, 4))
# 2. Convert it to float and store in X2_float.
X2_float = X2.float()
# 3. Show the difference (X2_float - X2) and explain why the difference is zero or non-zero.
difference = X2_float - X2
print(f"Difference: \n{difference}")
# The difference is zero because converting an integer tensor to float does not change the values,
# only the data type.
Difference:
tensor([[0., 0., 0., 0.],
[0., 0., 0., 0.],
[0., 0., 0., 0.],
[0., 0., 0., 0.]])
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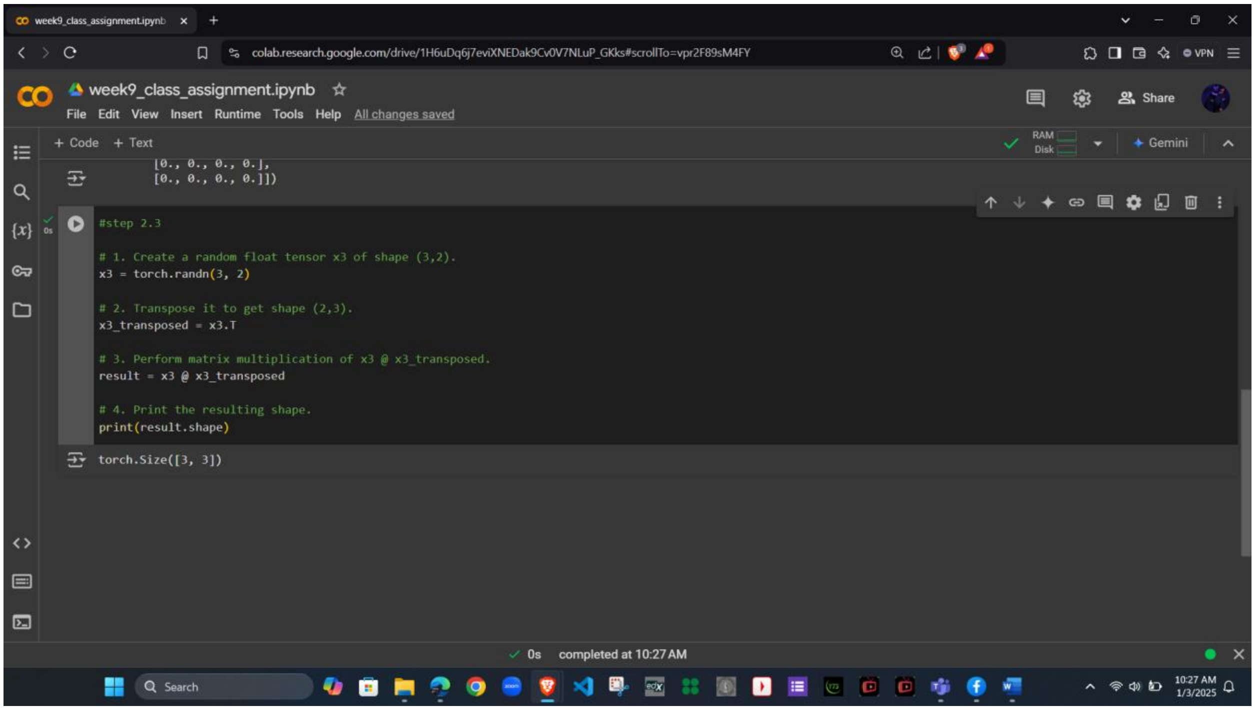
Step 2.3: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[0., 0., 0., 0.],
[0., 0., 0., 0.]])
#step 2.3
# 1. Create a random float tensor x3 of shape (3,2).
x3 = torch.randn(3, 2)
# 2. Transpose it to get shape (2,3).
x3_transposed = x3.T
# 3. Perform matrix multiplication of x3 @ x3_transposed.
result = x3 @ x3_transposed
# 4. Print the resulting shape.
print(result.shape)
torch.Size([3, 3])
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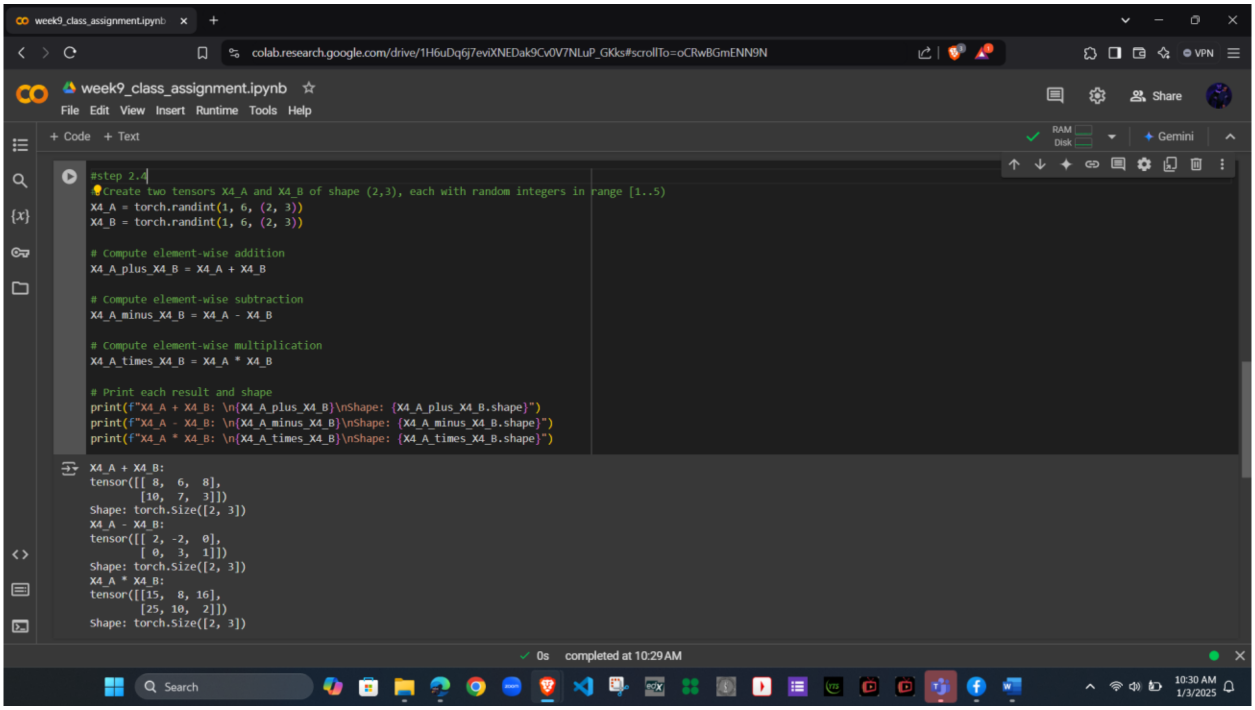
Step 2.4: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#step 2.4
#Create two tensors X4_A and X4_B of shape (2,3), each with random integers in range [1..5)
X4_A = torch.randint(1, 6, (2, 3))
X4_B = torch.randint(1, 6, (2, 3))
# Compute element-wise addition
X4_A_plus_X4_B = X4_A + X4_B
# Compute element-wise subtraction
X4_A_minus_X4_B = X4_A - X4_B
# Compute element-wise multiplication
X4_A_times_X4_B = X4_A * X4_B
# Print each result and shape
print(f"X4_A + X4_B: \n{X4_A_plus_X4_B}\nShape: {X4_A_plus_X4_B.shape}")
print(f"X4_A - X4_B: \n{X4_A_minus_X4_B}\nShape: {X4_A_minus_X4_B.shape}")
print(f"X4_A * X4_B: \n{X4_A_times_X4_B}\nShape: {X4_A_times_X4_B.shape}")
X4_A + X4_B:
tensor([[8, 6, 8],
[10, 7, 3]])
Shape: torch.Size([2, 3])
X4_A - X4_B:
tensor([[2, -2, 0],
[0, 3, 1]])
Shape: torch.Size([2, 3])
X4_A * X4_B:
tensor([[15, 8, 16],
[25, 10, 2]])
Shape: torch.Size([2, 3])
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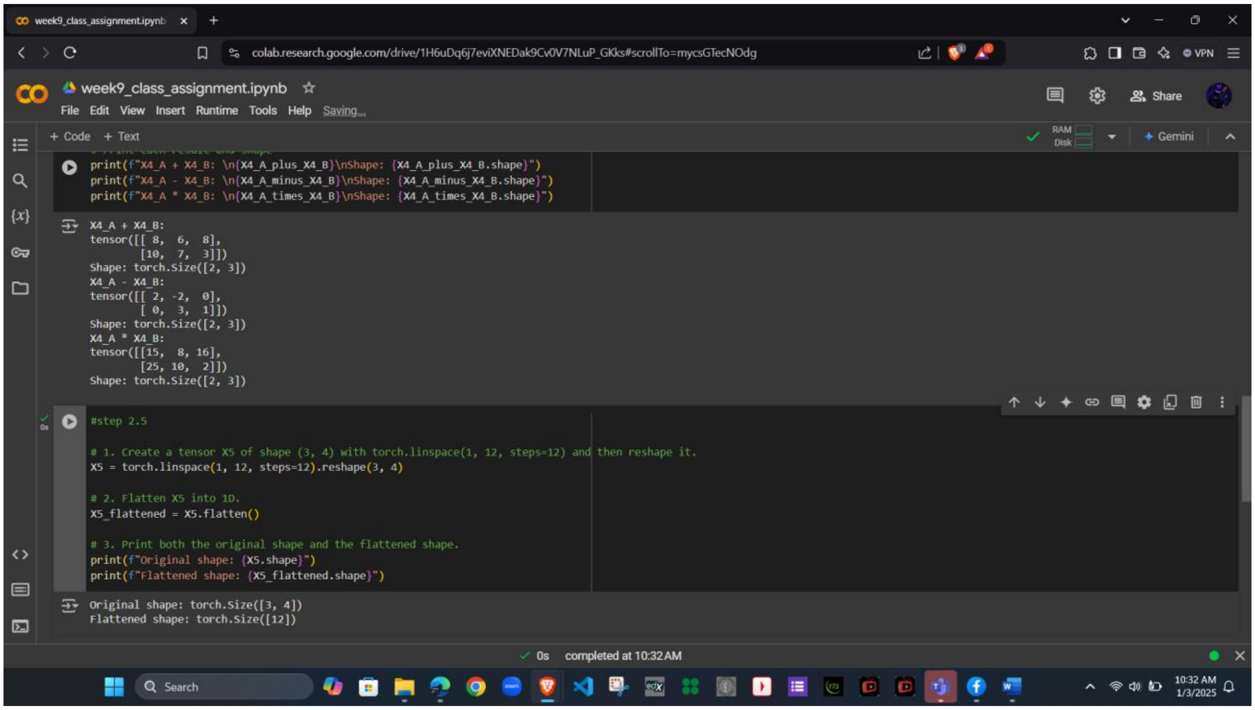
Step 2.5: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print(f"X4_A + X4_B: \n{X4_A_plus_X4_B}\nShape: {X4_A_plus_X4_B.shape}")
print(f"X4_A - X4_B: \n{X4_A_minus_X4_B}\nShape: {X4_A_minus_X4_B.shape}")
print(f"X4_A * X4_B: \n{X4_A_times_X4_B}\nShape: {X4_A_times_X4_B.shape}")
X4_A + X4_B:
tensor([[8, 6, 8],
[10, 7, 3]])
Shape: torch.Size([2, 3])
X4_A - X4_B:
tensor([[2, -2, 0],
[0, 3, 1]])
Shape: torch.Size([2, 3])
X4_A * X4_B:
tensor([[15, 8, 16],
[25, 10, 2]])
Shape: torch.Size([2, 3])
#step 2.5
# 1. Create a tensor X5 of shape (3, 4) with torch.linspace(1, 12, steps=12) and then reshape it.
X5 = torch.linspace(1, 12, steps=12).reshape(3, 4)
# 2. Flatten X5 into 1D.
X5_flattened = X5.flatten()
# 3. Print both the original shape and the flattened shape.
print(f"Original shape: {X5.shape}")
print(f"Flattened shape: {X5_flattened.shape}")
Original shape: torch.Size([3, 4])
Flattened shape: torch.Size([12])
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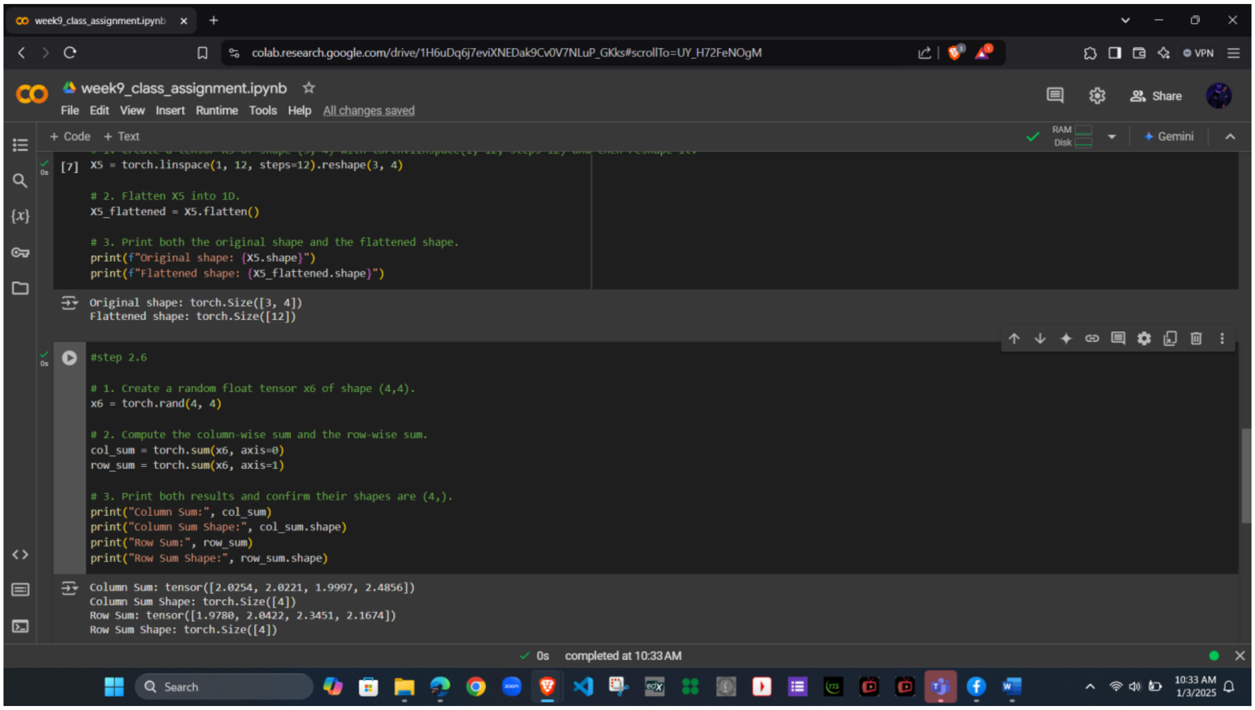
Step 2.6: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[7] X5 = torch.linspace(1, 12, steps=12).reshape(3, 4)
# 2. Flatten X5 into 1D.
X5_flattened = X5.flatten()
# 3. Print both the original shape and the flattened shape.
print(f"Original shape: {X5.shape}")
print(f"Flattened shape: {X5_flattened.shape}")
Original shape: torch.Size([3, 4])
Flattened shape: torch.Size([12])
#step 2.6
# 1. Create a random float tensor x6 of shape (4,4).
x6 = torch.rand(4, 4)
# 2. Compute the column-wise sum and the row-wise sum.
col_sum = torch.sum(x6, axis=0)
row_sum = torch.sum(x6, axis=1)
# 3. Print both results and confirm their shapes are (4,).
print("Column Sum:", col_sum)
print("Column Sum Shape:", col_sum.shape)
print("Row Sum:", row_sum)
print("Row Sum Shape:", row_sum.shape)
Column Sum: tensor([2.0254, 2.0221, 1.9997, 2.4856])
Column Sum Shape: torch.Size([4])
Row Sum: tensor([1.9780, 2.0422, 2.3451, 2.1674])
Row Sum Shape: torch.Size([4])
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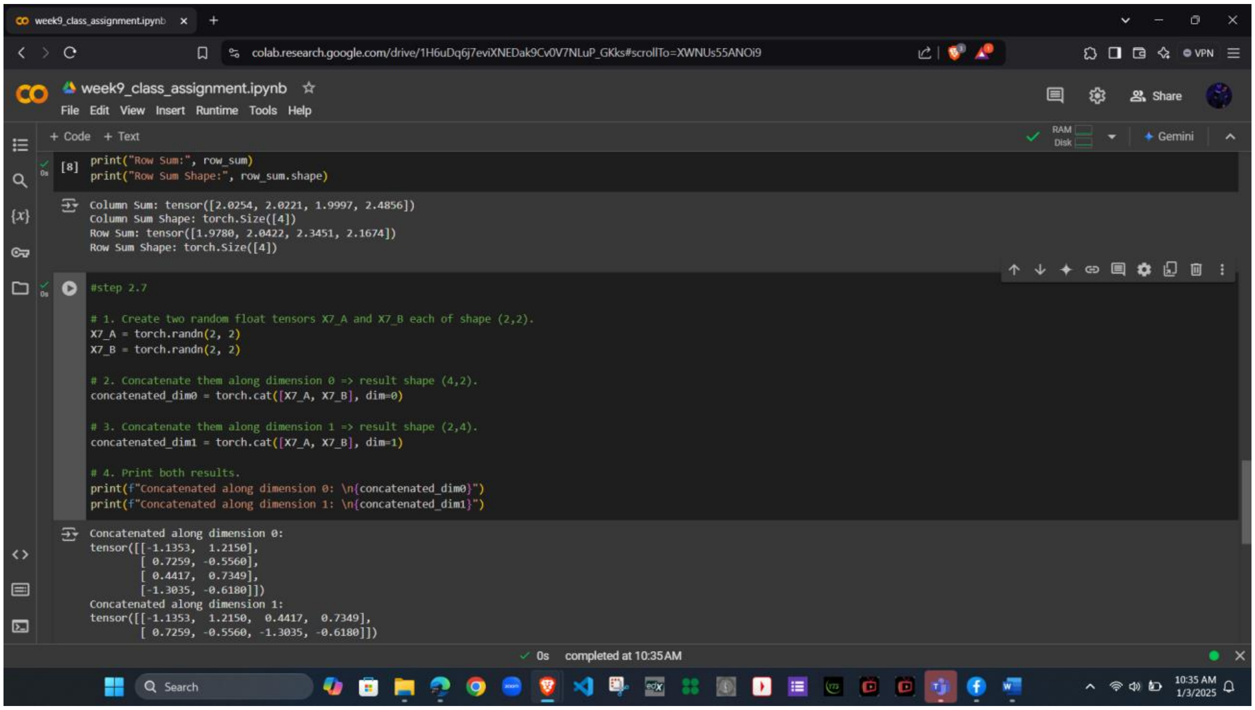
Step 2.7: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[8]
print("Row Sum:", row_sum)
print("Row Sum Shape:", row_sum.shape)
Column Sum: tensor([2.0254, 2.0221, 1.9997, 2.4856])
Column Sum Shape: torch.Size([4])
Row Sum: tensor([1.9780, 2.0422, 2.3451, 2.1674])
Row Sum Shape: torch.Size([4])
#step 2.7
# 1. Create two random float tensors X7_A and X7_B each of shape (2,2).
X7_A = torch.randn(2, 2)
X7_B = torch.randn(2, 2)
# 2. Concatenate them along dimension 0 => result shape (4,2).
concatenated_dim0 = torch.cat([X7_A, X7_B], dim=0)
# 3. Concatenate them along dimension 1 => result shape (2,4).
concatenated_dim1 = torch.cat([X7_A, X7_B], dim=1)
# 4. Print both results.
print(f"Concatenated along dimension 0: \n{concatenated_dim0}")
print(f"Concatenated along dimension 1: \n{concatenated_dim1}")
Concatenated along dimension 0:
tensor([[-1.1353, 1.2150],
[0.7259, -0.5560],
[0.4417, 0.7349],
[-1.3035, -0.6180]])
Concatenated along dimension 1:
tensor([[-1.1353, 1.2150, 0.4417, 0.7349],
[0.7259, -0.5560, -1.3035, -0.6180]])
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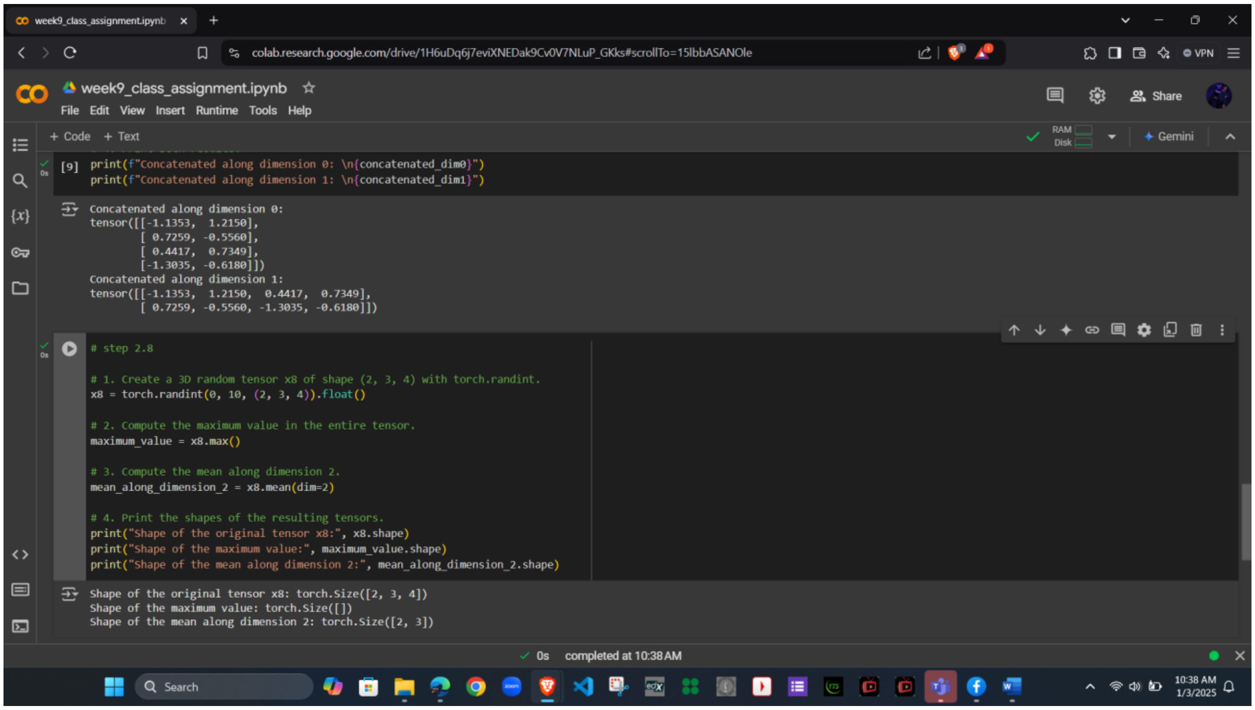
Step 2.8: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[9] print(f"Concatenated along dimension 0: \n{concatenated_dim0}")
print(f"Concatenated along dimension 1: \n{concatenated_dim1}")
Concatenated along dimension 0:
tensor([[-1.1353, 1.2150],
[0.7259, -0.5560],
[0.4417, 0.7349],
[-1.3035, -0.6180]])
Concatenated along dimension 1:
tensor([[-1.1353, 1.2150, 0.4417, 0.7349],
[0.7259, -0.5560, -1.3035, -0.6180]])
# step 2.8
# 1. Create a 3D random tensor x8 of shape (2, 3, 4) with torch.randint.
x8 = torch.randint(0, 10, (2, 3, 4)).float()
# 2. Compute the maximum value in the entire tensor.
maximum_value = x8.max()
# 3. Compute the mean along dimension 2.
mean_along_dimension_2 = x8.mean(dim=2)
# 4. Print the shapes of the resulting tensors.
print("Shape of the original tensor x8:", x8.shape)
print("Shape of the maximum value:", maximum_value.shape)
print("Shape of the mean along dimension 2:", mean_along_dimension_2.shape)
Shape of the original tensor x8: torch.Size([2, 3, 4])
Shape of the maximum value: torch.Size([])
Shape of the mean along dimension 2: torch.Size([2, 3])
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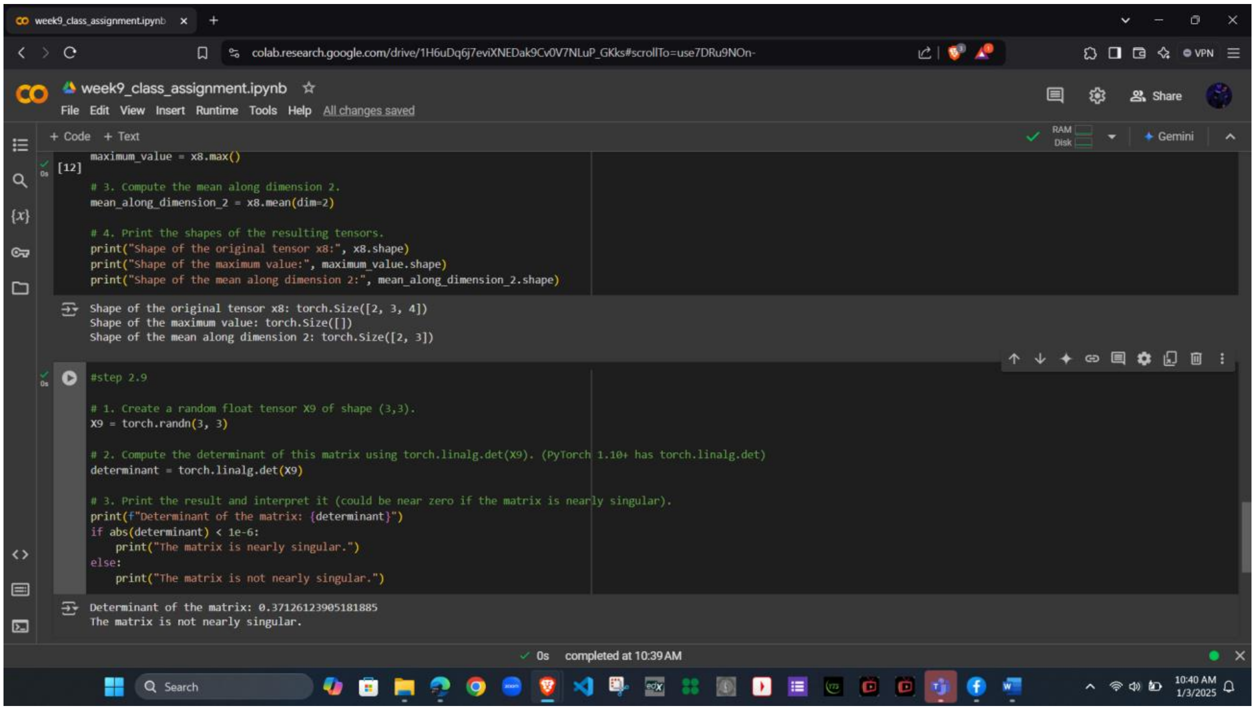
Step 2.9: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maximum_value = x8.max()
[12]
# 3. Compute the mean along dimension 2.
mean_along_dimension_2 = x8.mean(dim=2)
# 4. Print the shapes of the resulting tensors.
print("Shape of the original tensor x8:", x8.shape)
print("Shape of the maximum value:", maximum_value.shape)
print("Shape of the mean along dimension 2:", mean_along_dimension_2.shape)
Shape of the original tensor x8: torch.Size([2, 3, 4])
Shape of the maximum value: torch.Size([])
Shape of the mean along dimension 2: torch.Size([2, 3])
#step 2.9
# 1. Create a random float tensor X9 of shape (3,3).
X9 = torch.randn(3, 3)
# 2. Compute the determinant of this matrix using torch.linalg.det(X9). (PyTorch 1.10+ has torch.linalg.det)
determinant = torch.linalg.det(X9)
# 3. Print the result and interpret it (could be near zero if the matrix is nearly singular).
print(f"Determinant of the matrix: {determinant}")
if abs(determinant) < 1e-6:
print("The matrix is nearly singular.")
else:
print("The matrix is not nearly singular.")
Determinant of the matrix: 0.37126123905181885
The matrix is not nearly singular.
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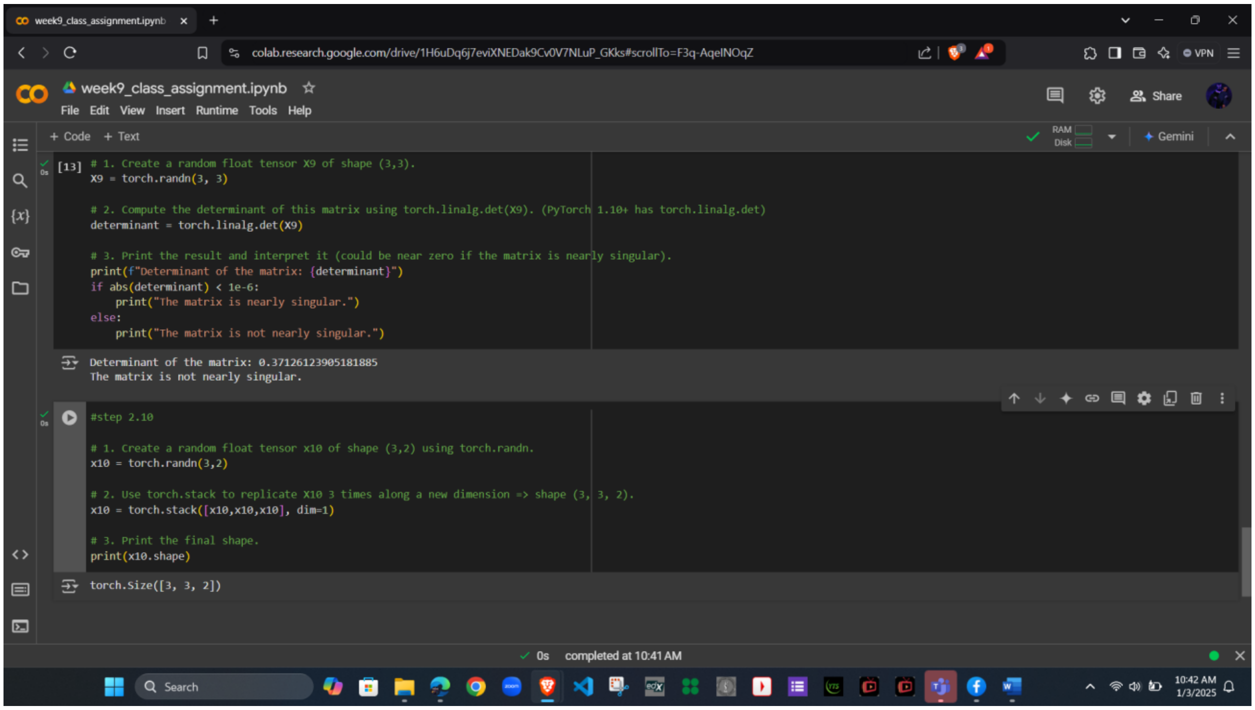
Step 2.10: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[13] # 1. Create a random float tensor X9 of shape (3,3).
X9 = torch.randn(3, 3)
# 2. Compute the determinant of this matrix using torch.linalg.det(X9). (PyTorch 1.10+ has torch.linalg.det)
determinant = torch.linalg.det(X9)
# 3. Print the result and interpret it (could be near zero if the matrix is nearly singular).
print(f"Determinant of the matrix: {determinant}")
if abs(determinant) < 1e-6:
print("The matrix is nearly singular.")
else:
print("The matrix is not nearly singular.")
Determinant of the matrix: 0.37126123905181885
The matrix is not nearly singular.
#step 2.10
# 1. Create a random float tensor x10 of shape (3,2) using torch.randn.
x10 = torch.randn(3,2)
# 2. Use torch.stack to replicate X10 3 times along a new dimension => shape (3, 3, 2).
x10 = torch.stack([x10,x10,x10], dim=1)
# 3. Print the final shape.
print(x10.shape)
torch.Size([3, 3, 2])
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