**Question 1. Tensor Decomposition Reconstructions (15 points)**

**Part 1.** Kruskal tensors are a way of representing tensor decompositions as a weighted sum of outer products.

for each rank of the decomposition, r, and rank of the original tensor, n.

a) Given the following rank-2 CP decomposition:

Write out the calculation of the first outer product

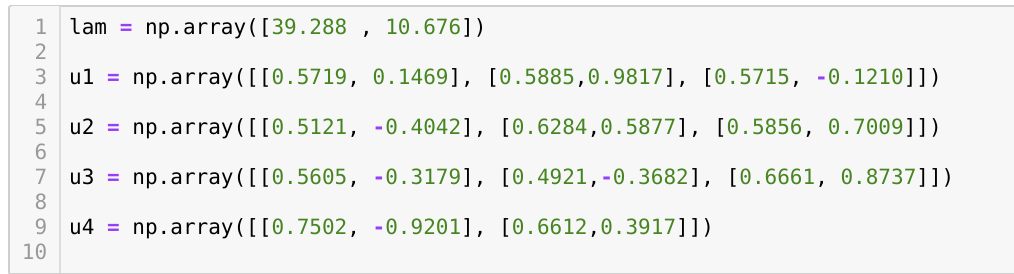
***Answer:***

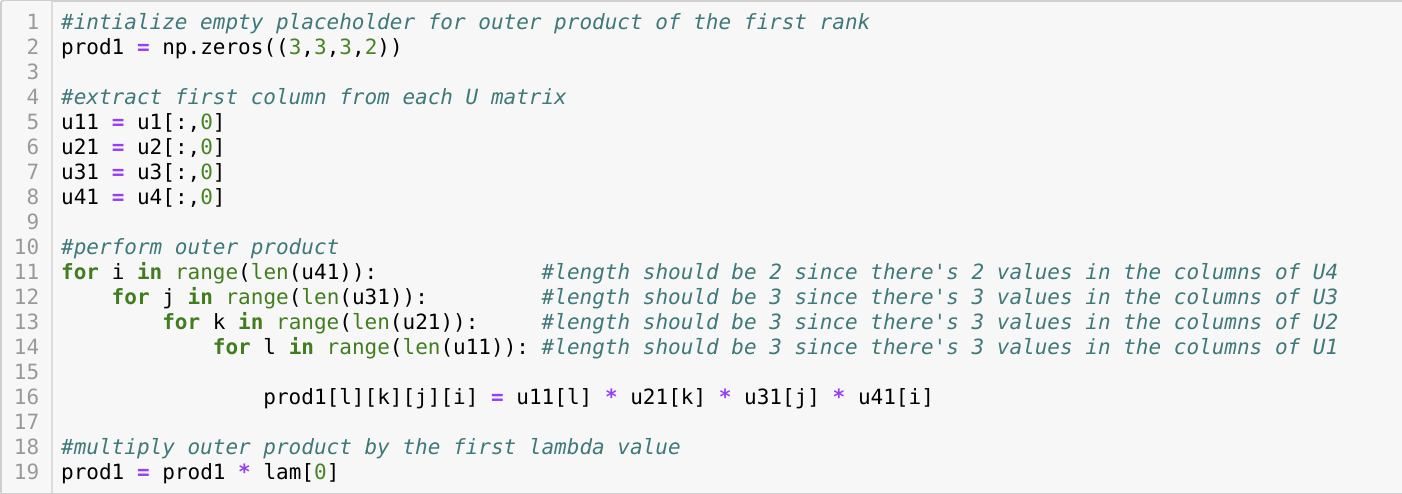
= U1,1 \* U2,1T

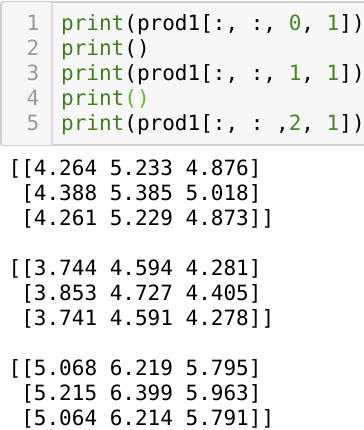
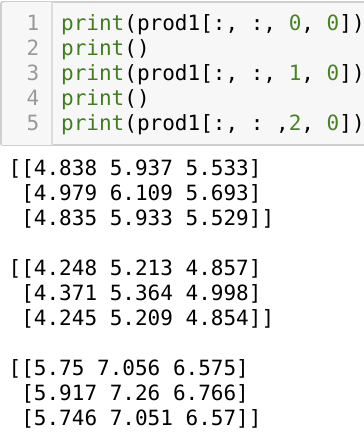
Where U1,1 = and U2,1T =

=

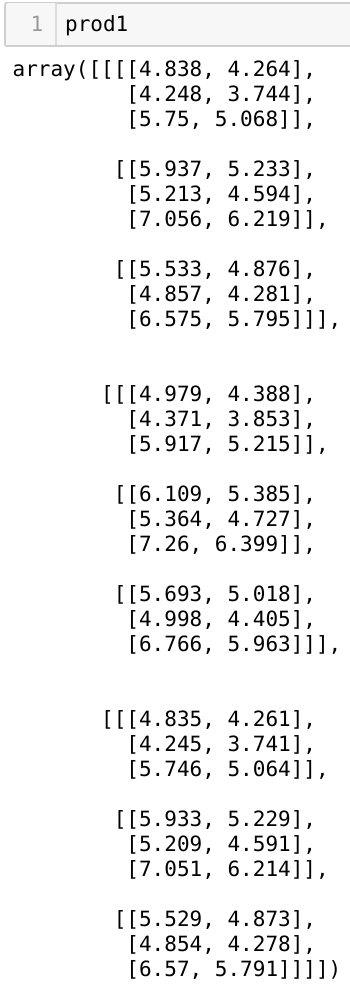
b) Either by hand or in code, calculate:

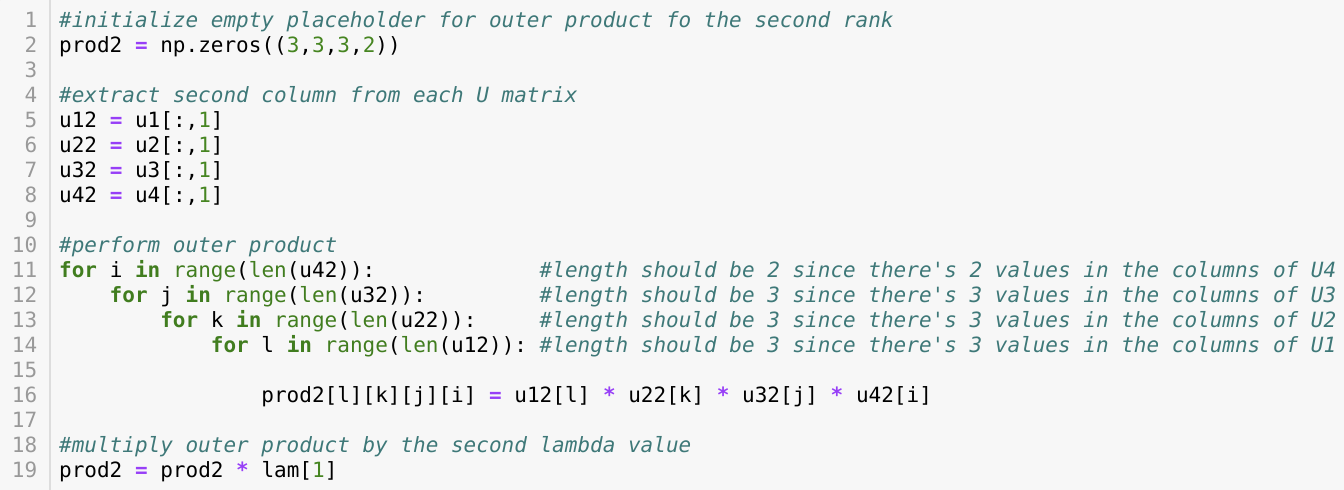


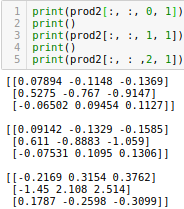
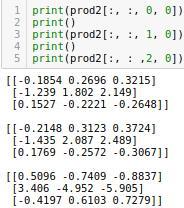
NOTE: Numpy is reorganizing the final array when printing out. When manually forcing orientation, this is my result:



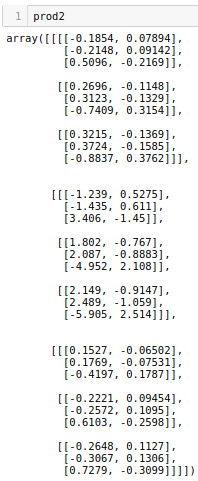
When printing out full array from numpy – this is the result



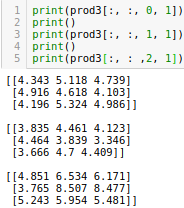
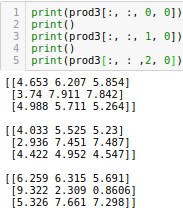




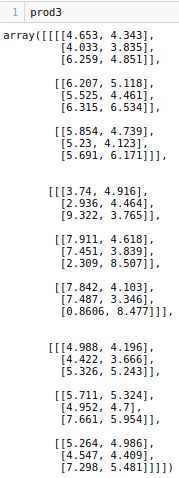
When printing out full array from numpy – this is the result



* the full reconstruction.



When printing out full array from numpy – this is the result



**Part 2.** A Tucker decomposition of the same original tensor is:

Compute the reconstruction of the Tucker decomposition.