Question 4:

A) Two Reordering Algorithms

Reverse Cuthill-McKee:

RCM reverses the traditional Cuthill-Mckee algorithm that reduces the bandwidth associated with a sparse symmetric matrix. Source: <https://crd.lbl.gov/assets/Uploads/RCM-ipdps17.pdf>

Pseudocode:

Graph G(A) = (V, E) //where vertices have their associated adjacent vertices

for i = 1 to A:

Add vertex A[i] to graph, add its adjacent vertices as well

Vector v1 //to return the ordered list

for i = 1 to n:

//BFS

Find all neighbors of the vertex A[i], push back v1 in order of neighbor degree

Return: Reverse(v1)

Approximate Minimum Degree:

The ALM algorithm utilizes a quotient graph, which contains a clique representing members rather than all edges. Source: <https://people.engr.tamu.edu/davis/publications_files/An_Approximate_Minimum_Degree_Ordering_Algorithm.pdf>

V1 = {1...n} //All vertices

Ep = {v1 ... vn} //Elimination set

For i = 1 to n:

Ai = {j for neighbors of v[1]} //determine neighbors of vertex

degree = len(Ai) //determine degree

i = 0

While i <= n:

Choose v[i] with minimum degree

Ep.remove() //Remove vertex from elimination set

For i in Ep:

Ai = Ai/Ep //Remove redundancy

degree = Ai/i //update degree after removal

End for each pair i and j in Ep: //Checking if the indices are the same

If i and j are the same:

i = i U j //Remove j

degree -= j //reduce degree by j

End if

End while

end

B) Memory Hierarchy

I examined the memory hierarchy for the Intel Xeon Platinum 8360Y. It has a total of 72 cores across 2 evenly divided sockets. The memory hiearchy includes an L1 Instruction and Data Cache with 32 KiB and 48 KiB, an L2 cache with 1280 KiB, and an L3 cache wwith 54 MiB. It possesses high memory bandwidth as well at 409 GB/s.  
C) Extra Credit