0.1 Let $G = (V, E)$ be an undirected graph. By the degree of a vertex $v \in V$, we mean the number of edges in E that are incident to v. For each of the following conditions on the graph G, is the condition satisfied only by dense graphs, only by sparse graphs, or by both some sparse and some dense graphs? As usual, $n = |V|$denotes the number of vertices. Assume that n is large (say, at least 10,000)

1. At least one vertex of G has degree at most 10.
2. Every vertex of G has degree at most 10.
3. At least one vertex of G has degree $n - 1$.
4. Every vertex of G has degree $n - 1$.

(1) both sparse and dense
(2) sparse
(3) both sparse and dense
(4) dense

0.2 Consider an undirected graph $G = (V, E)$ that is represented as an adjacency matrix. Given a vertex $v \in V$, how many operations are required to identify the edges incident to v?

1. $\Theta(1)$
2. $\Theta(k)$
3. $\Theta(n)$
4. $\Theta(m)$

(3) We are required to check the columns of the vertex v to determine all vertices adjacent to v. Since we have an $N \times N$ matrix this $\Theta(n)$.

0.3 Consider a directed graph $G = (V, E)$ represented with adjacency lists, with each vertex storing an array of its outgoing edges. Given a vertex $v \in V$, how many operations are required oto identify the incoming edges of v?

1. $\Theta(1)$
2. $\Theta(k)$
3. $\Theta(n)$
4. $\Theta(m)$

(4) For the adjacent list representation we have a list of size m where m denotes the number of edges. We iterate through the list and count the number of times that vertex v is an right endpoint of an edge. This gives us an order of m and hence $\Theta(m)$.