1) List the first seven 3-combinations from the set \{a, b, c, d, e\} in lexicographic order. (6 points)

2) List all permutations from the set \{3, 6, 7\} in lexicographic order. (6 points)

3) You flip a coin 9 times. What is the probability of getting three heads and the rest tails? (6 points)

4) A card is selected at random from a standard deck of 52 cards. What is the probability that it is a clubs? (4 points)

5) A standard deck of 52 cards is sitting on a table. You draw 2 cards. What is the probability that the second card you draw is a queen? (4 points)
6) Two standard dice are rolled. What is the probability that the two numbers sum to 8? (6 points)

7) Write down \((a + b)^{38}\) as a summation of each of the 39 terms. (4 points)

8) What is the term containing \(x^{14}\) in \((x + 2y)^{50}\)? (6 points)

9) Draw an example of a path with 5 vertices (4 points)

10) Sketch a graph with 8 vertices in which each vertex has degree 3. (4 points)
11) On the graph below, use Dijsktra’s algorithm to find the shortest path from \( v \) to \( w \). Please effectively illustrate how the algorithm works. (10 points)
12) Below is a graph (actually 8 drawings of it). You can run Dijkstra’s algorithm to find the shortest path from $v$ to $w$ - do so, using each new graph to illustrate one new step. You might not need all 8 copies of the graph. (8 points)
13) In the graph below, identify a bipartite subgraph. Illustrate why the subgraph you chose is bipartite. (6 points)

14) Sketch a graph with the incidence matrix given below. (4 points)

\[
\begin{bmatrix}
0 & 1 & 1 & 0 & 0 & 0 \\
1 & 0 & 1 & 1 & 0 & 1 \\
1 & 0 & 0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 \\
\end{bmatrix}
\]
15) Using the graph below, either find and label a Hamiltonian cycle, or give a reason for why one does not exist. (6 points)

16) Using the graph below, either find and label an Eulerian tour, or give a reason for why one does not exist. (6 points)
17) Sketch two graphs, each with 6 vertices, that are not isomorphic. (3 points)

18) Sketch two graphs, each with 6 vertices, that are isomorphic. (3 points)

19) In the graph below, what is the degree of \( v \)? (4 points)

20) **Bonus Question.** Let \( G \) be a graph with \( n \) vertices and \( m \) edges. Using proper notation, give an obvious lower bound on the runtime needed to find an Eulerian tour. (2 points)