# Background Knowledge (Total 39 points)

This section tries to ascertain some basic knowledge we hope you acquired before. This is not a quiz, and

your performance here will not affect your grade. However, if you have serious problems in this section, it may be in your own best interest to review the background material in order to do well in this class.

1. Which of these sorting algorithms have a worst-case running time of Ω(n2) — mark all that apply: Bubble Sort, Heap Sort, Insertion Sort, Merge Sort, Quick Sort (with good median finding), Selection Sort. **(3 points, 1 point for each item)**

Answer: Bubble Sort, Insertion Sort, Selection Sort

1. Which of these sorting algorithms have a worst-case running time of O(n log n) — mark all that apply: Bubble Sort, Heap Sort, Insertion Sort, Merge Sort, Quick Sort (with good median finding), Selection Sort **(3 points, 1 point for each item)**

Answer: Heap Sort, Merge Sort, Quick Sort

1. Which of these functions are O(n2) — mark all that apply: 3, (2n)2, (log n)4, 2n, 1/100 n3, log logn,

4n log n, n2 + 4n log n. **(6 points, 1 point for each item)**

Answer: 3, (2n)2, (log n)4 , log log n, 4n log n, n2 + 4n log n.

1. Which of these functions are Ω(n2) — mark all that apply: 3, (2n)2, (log n)4, 2n, 1/100 n3, log logn,

4n log n, n2 + 4n log n. **(4 points, 1 point for each item)**

Answer: , (2n)2, 2n, 1/100 n3, n2 + 4n log n

1. Among the following subsets of (undirected) graphs, determine which are subsets of each other: (1) cycle (2) tree, (3) forest, (4) connected graph, (5) acyclic graph, (6) bipartite graph, (7) path. For each class A, list all classes B such that the following statement holds: “every A is also a B”.

**(11 points, 1 point for each item)**

Answer:

A: Cycle (1) B: Connected graph (4)

A: Cycle (1) B: Path(7)

A: Tree (2) B: Forest(3)

A: Tree (2) B: Connected graph (4)

A: Tree (2) B: Acyclic graph (5)

A: Tree (2) B: Bipartite graph (6)

A: Forest (3) B: Acyclic graph (5)

A: Forest (3) B: Bipartite graph (6)

A: Path (7) B: Connected graph (4)

A: Acyclic graph(5) B: Forest(3)

A: Acyclic graph(5) B: Bipartite graph(6)

1. In a graph with n nodes and m edges how long does it take to **(4 points, 1 point for each item)**
   1. Run BFS to find out if there is a path from node A to node B O(n+m) or O(m)
   2. Run DFS to find out if there is a path from node A to node B O(n+m) or O(m)
   3. Run BFS to find all points that can be reached from A O(n+m) or O(m)
   4. Run DFS to find all points that can be reached from A O(n+m) or O(m)
2. Which of the following statements are true? **(8 points, 1 point for each item)**
   1. BFS can be used to find the shortest path in a weighted undirected graph F
   2. DFS can be used to find the shortest path in a weighted undirected graph F
   3. BFS can be used to find the shortest path in a weighted directed graph F
   4. DFS can be used to find the shortest path in a weighted directed graph F
   5. BFS can be used to find the shortest path in an undirected graph with equal cost edges T
   6. DFS can be used to find the shortest path in an undirected graph with equal cost edges F
   7. BFS can be used to find the shortest path in a directed graph with equal cost edges T
   8. DFS can be used to find the shortest path in a directed graph with equal cost edges F