Question 1

a)

i) 4 + 2 \* 3 + 2

Postfix: 4 2 3 \* + 2 +

|  |  |  |
| --- | --- | --- |
| Token | Postfix | Stack |
| 4 | 4 | <empty> |
| + | 4 | + |
| 2 | 4 2 | + |
| \* | 4 2 | + \* |
| 3 | 4 2 3 | + \* |
| + | 4 2 3 \* | ++ |
| 2 | 4 2 3 \* + 2 | + |
| <end> | 4 2 3 \* + 2 + | <empty> |

ii) (4 + 2) \* 3 + (4 + 5) \*7

Postfix: 4 2 + 3 \* 4 5 + 7 \* +

|  |  |  |
| --- | --- | --- |
| Token | Postfix | Stack |
| ( |  | ( |
| 4 | 4 | ( |
| + | 4 | ( + |
| 2 | 4 2 | ( + |
| ) | 4 2 + | <empty> |
| \* | 4 2 + | \* |
| 3 | 4 2 + 3 | \* |
| + | 4 2 + 3 \* | + |
| ( | 4 2 + 3 \* | + ( |
| 4 | 4 2 + 3 \* 4 | + ( |
| + | 4 2 + 3 \* 4 | + ( + |
| 5 | 4 2 + 3 \* 4 5 | + ( + |
| ) | 4 2 + 3 \* 4 5 + | + |
| \* | 4 2 + 3 \* 4 5 + | + \* |
| 7 | 4 2 + 3 \* 4 5 + 7 \* | + |
| <end> | 4 2 + 3 \* 4 5 + 7 \* + | <empty> |

Both merge and quick sorts used in 1b and 1c are O(N log N) sorting algorithms. Both questions used the integers in my student number 21029112 as the array to be sorted. Question 1b used the integers directly as the array [2,1,0,2,9,1,1,2] while question 1c first threw the integers into an ascending numbers array [0,1,1,1,2,2,2,9]. My answer for the recursion calls for both 1b and 1c resulted in 3 levels of recursion each. Merge sorts are stable sorts and therefore no matter what, there will always be the same amount of function calls and levels of recursion. However, while answering question 1c, I have assumed the best base for the quicksort where every pivot splits the sub arrays exactly in half which results in 3 levels of recursion and the number of function calls in my answer. Hence knowing this, if an array of 100 elements were thrown into the merge function, it will always result in the same level of recursion and the same amounts of function calls. The level of recursion in this case would be 7. However, if the same array of 100 elements were thrown into the quicksort, the level of recursion and function calls would depend on the best, average or worst case of sorting for the quicksort. If the quicksort occurs in the best case, the level of recursion would be the same as the mergesort which would be 7 levels.