

1. Circular queues are used quite a bit in operating systems and high performance systems, especially when performance matters. Do a little outside research, and explain the reason a ring buffer useful and/or when should it be used?

Circular queues can be applied in different areas especially when the data input and data output are at different rates. There are two pointers for circular, input(enqueue) only affects the back pointer and the out(dequeue) only affects the front pointer. This will protect the data being overwritten if there is only one user for input and one user for output. Also, when the new item is inserted, we do not need to shift the data, so we do not need to copy the data around, which reduce the risk of overwritten.

In addition, when we know the maximum size (elements) for queue, circular queue is useful because we do not need infinite memory and we use reuse the memory if an item is dequeued from the circular queue. This will help us save memory and use the memory for other programs, so it is memory-efficiency.

Real-world examples where circular queues are used:

1. Computer controlled Traffic Signal System
2. CPU scheduling and Memory management.

(from <https://www.studytonight.com/data-structures/circular-queue>)

2. We are going to talk about stacks quite a lot in this course, so it will be important to understand them. Do a little outside research, and explain why a stack is useful and/or when it should be used?

Stacks use the LIFO method so it is easy to manage data. For example, a stack can be used to retrieve recently used objects from a cache. Also, we could use a stack for backtracking, depth-first-search and recursion since the last added item can be removed first.

Stacks could also be used in compile-time memory management. Stack-based memory allocation is one example. It is much simpler and faster than other memory allocation. It is useful to store temporary data or the data we do not need after the current function exits.

([https://en.wikipedia.org/wiki/Stack\\_\(abstract\\_data\\_type\)#Applications\\_of\\_stacks](https://en.wikipedia.org/wiki/Stack_(abstract_data_type)#Applications_of_stacks))