UNIVERSITÄT DUISBURG ESSEN

NES Networked Embedded Systems

Programming in C/C++

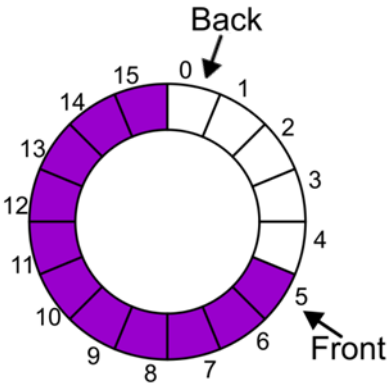
Exercises 9

1. Wireless signals are commonplace in the environment today. Provided in signals.cpp is a class modelling such signals. Complete the class and the program with the following.

- Overload the input operator >> of the `Signal` class to be able to read and parse a comma-separated string to create a Signal (see sample signals.txt file).
- Overload the output operator << of Signal class to output the signal readings in the CSV format (as shown in the sample signals.txt file).
- Implement the function std::vector readSignals(char* filepath) to read and parse the provided CSV file. Each line in the file represents a signal and the vector list of signals should be returned. Use the overloaded input operator!
- Implement the function std::vector<Signal> filterSignals(SignalType type, std::vector<Signal>&) which returns a new vector containing only signals which have the signal type specified.
- Implement the function void writeSignals(char* filename, std::vector& signals) to write the signals from a provided vector to a file with filename specified in the parameter. Use the overloaded output operator!

Use the provided signals.cpp file and add your code to it. The read and write functions should output a log line to the console stating what the function is doing. Make sure to properly comment the functions. (Hint: you will need the –std=c++11 flag when compiling)
(code 25 pts, comments 5 pts)

2. (Double ended) queues with fixed size can also be implemented as ring buffer. All elements are stored in an array using two indices “back” and “front”. As shown in the figure, “front” points to the first element in the queue, “back” to the element past the last element (similar to STL iterators). Pushing to the back or popping from the front increases the back or front indices, respectively. If an index is to be increased at position 15 it restarts at position 0. Popping from the back and pushing to the front works with decreasing the indices and an analogous adjustment.



Implement a template class “RingBuffer” for double ended queues in file “ringbuffer.hpp”. The template can be parameterized with the type of objects and the maximum number of elements that can be stored in the queue, e.g. “RingBuffer<int, 3> rb;”.
The queue shall support the operations push_front, pop_front, push_back, pop_back, empty, full, print. The pop operations should return the value from the corresponding position. If a push operation is called on a full queue, the object shall be dropped silently. If a pop operation is called on an empty queue, a runtime_error() exception shall be thrown. The print method shall print out the complete queue from front to end.
Use an internal counter to keep track of the number of elements in the queue!
(code 60 pts, comments 10 pts)

Bonus: Implement an alternative version that shall behave in the same way as the original RingBuffer from a user's point of view but instead of using an internal counter it relies on the values of "front" and "back" for all operations only.
If you do it right, only minimal changes are required.
(Side note: In good ol' DOS days, the keyboard buffer was organized in this way, having a pointer to the last and next character without an explicit counter.)
(code 5 pts)