Features:

* Re-entrant mutex
* Fixed-priority scheduler
* Task Sleep
* Wait and notify
* Mutex priority inheritance
* Queue-based task communication
* Memory pool

## Fixed-priority scheduler

Min-heap containing different priority levels, where each priority level is a queue. Also contains pending-list for task waiting to be added to queue.

Functions required in module:

* Add task (external)
* Remove task (internal)
* modify priority level (external) (do through delegate)
* \_OS\_schedule (external)
* add to pending list

When adding a task must:

* Add priority level to heap if previously empty
* Ensure heap is sorted

When removing a task must:

* Remove priority level from heap if it is now empty
* Ensure heap is sorted

When modifying priority level must:

* Retain value of priority level assigned at runtime
* Can move tasks just by referencing next/prev pointers
* Modify task state bits to show it has been modified

By making our modify priority function ran by an interrupt, along with the schedule function. We can maintain task list exclusivity as there will never be 2 functions attempting to change the task list at once. SVC interrupt is higher priority than PendSV so a context switch won’t affect the modify priority delegate, and the SVC is only called by software which won’t happen during a context switch, hence the 2 interrupts will not affect each other.

RULE: ONLY MODIFY TASK LIST FROM WITHIN SVC DELEGATES

## Re-entrant Mutex

Contains pointer to task that owns mutex, min-heap wait list and a check code that is incremented every time a task is notified to aid in exclusivity.

## Sleep Module

Min-heap list of sleeping tasks, on context switch, only first task checked to see whether can wake. sleep timer must use a signed value to aid in integer overflow of systick.

Sleep function runs from software

## Min-heap module

Requires add/extract functionality

Requires thread safety

Will need dynamic memory allocation. Use memory pool for this

## Memory Pool

Cry and weep fool

## Demonstration to use features:

Must show:

* Schedule prioritises tasks
* Mutex inherits priority
* Can sleep/pause tasks
* Task communication