CS 518 Assignment 1

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Structures created for the Task

- Thread, Mutex and Queue (for both Multi-Level Feedback Queue(MLFQ) and Wait Queue).
- MLFQ and Wait Queue are instances of 'queue' structure defined in header file.
- Threads are instances of the 'my_pthread_t' structure defined in header file.
- Mutexes are instances of the 'my_pthread_mutex_t' structure defined in header file.
- Fields in structure of 'my_pthread_t' : ucontext structure, pointer to next thread in MLFQ/Wait Queue, thread state, id, running time, priority, return value, last_exec_time
- Fields in structure of 'my_pthread_mutex_t : lock, thread which owns lock, wait queue

Specifications

- Stack memory for each thread : 16 kB
- Possible states for a thread defined as an enum in header file : READY, RUNNING, WAITING, YIELDED, FINISHED
- Signal generation frequency : 50 ms (Signal handler function : void scheduler())
- Number of levels in MLFQ : 16 (0 : highest priority, 15 : lowest priority)
- Time quanta for each level : (level+1) * 50ms
- Check for starvation : 50 (after every 50 time quanta of 50 ms each)

Scheduler

- The scheduler is initialized when the first thread is created (checked using a flag)
- Timer is reset in the scheduler function to 50 ms
- Fetch next thread for execution after Enqueue-ing current thread into appropriate queue
- Check for starvation in all threads in MLFQ and Enqueue starved threads into Queue with highest priority
- Swap context to current thread and proceed with execution of that thread

Benchmarking functions

- Function which increments the value of a variable by 100 with mutex (f1_with_mutex())
- Function which decrements the value of a variable by 50 with mutex (f2_with_mutex())
- Function which increments the value of a variable by 100 without mutex (f1_without_mutex())
- Function which decrements the value of a variable by 50 without mutex (f2_without_mutex())
- Function to test 'my_pthread_yield' (my_pthread_join() and f6())
- Function to test 'my_pthread_exit' (f5())
- Function to test 'my_pthread_join' (f7())