Operating System **Hsu PO-CHUN**
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Prof. Pai H. Chou Submitted: Oct. 15, 2017
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Assignment 4

1 Problem 1

[20 points] Under what circumstances does a multithreaded solution using multiple kernel threads provide better performance than a single-threaded solution on a single-processor system?

1.1 Answer

The following circumstances are multitread solution better than a single thread solution on a single processor system:
1. Services requested by a web server is served by multithreads.
2. Executing parallelized programs such as quick sort.
3. When occurring page faults to one kernel thread, it can switch to another kernel thread in order to improve CPU utilization.
4. When programs have to wait for many events in the system, it is better that switch to another kernel thread rather than just waiting.

2 Problem 2

[20 points] Which of the following components of program state are shared across threads in a multithreaded process?

a. Register values

b. Heap memory

c. Global variables

d. Stack memory

2.1 Answer

b. Heap memory and **c. Global variables** are shared across threads in a multithreaded process. In multithreaded process, each thread has its own stack and register values.

3 [10 points] Performance Analysis

Table 1: Performance

time python3 quicksort.py	real 3m9.350s user 2m37.900s sys 0m9.536s
time python3 qsortTh.py	real 4m11.447s user 3m3.136s sys 0m18.804s
time ./quicksort	real 0m8.229s user 0m8.128s sys 0m0.052s
time ./qsortTh	real 0m8.023s user 0m7.912s sys 0m0.064s

The thread version is slower in python.

Because Python interpreter only using user level library to execute the user program, all threads run on 1 core only. Hence, it takes more time on thread-creations and thread-switchings.
The thread version is faster in C.

Because C compiler compile source code into executable code,it can leverage kernel threads and another optimizations as well, it is faster in C and much faster in C with pthread.