8:4 Define process and thread. How a multithreaded model is better as compared to multiprocess model having single thread. What are kernel and user threads? Explain the mapping between them.

Soln: (a) Process — It is an executing instance of a program

Threads — Basic unit to which the operating system allocates processor time. A thread is a path of execution within a process.

Threads within the same process share the same address space, whereas different processes do not. This allows threads to write and read to the same data structures and variables, and also facilitates communication between threads.

Threads are considered lightweight because they use far less resources than processes.

A process can have multiple threads.

(b) Benefits of Multi-threading

(i) Parallelism — In machines with multiple processors, threads provide an efficient way to achieve true parallelism. As each thread receives its own processor individually and is schedulable entity, multiple threads may run on multiple processors at the same time, improving a system's throughput.

(ii) Programming abstraction — Dividing up the work and assigning each division to ~~each~~ a unit of execution is a natural approach to many problems.

(iii) Blocking I/O — Without threads, blocking I/O halts the whole process. This negatively affects throughput and latency. In a multithreaded process individual threads may block, waiting for I/O, while other threads make progress.