student name [ ]

American University of Central Asia
Software Engineering Department

Parallel Programming (COM 451)
Midterm Examination

- You have one hour and fifteen minutes to finish the test.
- Circle one or several correct answers.
- In questions with several correct answers you have to select all of them to get a point.
- You can cross answers selected by a mistake.
- You can use the back of the sheets of paper to make notes.

1. According to the Flynn's taxonomy a modern multi-core x86-64 CPU can work as a...
   a) a SISD machine
   b) a SIMD machine
   c) a MIMD machine
2. What is the main problem of having long CPU pipelines?
   a) A long pipeline increases chances to get cache trashing.
   b) An if statement in a loop of any high-level program can lead to major degradation of performance.
3. POSIX Threads library is considered to be...
   a) a shared-memory parallel programming API
   b) a distributed-memory parallel programming API
4. Which OS abstraction requires less time on average to switch a context on a CPU?
   a) a thread
   b) a process
5. Which element from the following list can NOT become a part of a thread?
   a) a private virtual address space
   b) a saved program counter
   c) a saved stack pointer
   d) saved general purpose registers
6. *thread_ data* is a stack variable of type *struct thread_ args*. An alias (address) of this variable can be accessed as...
   a) **thread_ data*
   b) *thread_ data*
   c) *&thread_ data*
   d) *(void *) thread_ data*
7. A thread failed to lock a mutex. The state of the thread will be...
   a) *ready*
   b) *terminated*
   c) *blocked*
   d) *running*
8. A thread was preempted by the OS scheduler. The state of the thread will be...
   a) *ready*
   b) *terminated*
   c) *blocked*
   d) *running*
9. Detaching a thread during thread execution will...
   a) terminate it immediately
   b) terminate it immediately and free resources used by this thread
   c) free resources used by this thread after thread termination
   d) free resources used by thread's attributes during execution
10. Can concurrency be achieved on a uniprocessor system?
    a) Yes
    b) No
11. A concurrent system must provide the following set of core essential functions
    a) Execution context, scheduling, synchronization
    b) Execution context, condition variables, semaphores
    c) Priority policies, asynchronous execution, mutual exclusions
12. A certain CPU instruction is not atomic. Several threads are trying to modify shared data on a multi-core machine by only using that specific instruction. Should any synchronization primitives be used to control access to the shared value?
    a) Yes, a critical section should be introduced with mutexes or semaphores to protect the data.
    b) Yes, a conditional variable should be used to protect the data.
    c) No
13. A certain CPU instruction guaranteed to be atomic. Several threads are trying to modify shared data on a multi-core machine by only using that specific instruction. Should any synchronization primitives be used to control access to the shared value?
    a) Yes, a critical section should be introduced with mutexes or semaphores to protect the data.
    b) Yes, a readers-writer lock should be used to protect the data.
    c) Yes, a conditional variable should be used to protect the data.
    d) No
14. What is the reason of wrapping the *pthread_ cond_ wait* call with a *while* loop.
    a) It is possible that multiple threads will wake up and the predicate will become false to some of them.
    b) As the mutex is not relocked after wakeup it is possible to get invalid predicate values for some threads.
15. Amdahl's law states that the speedup that can be achieved by using a parallel system for the ratio P of a program that can be made parallel with the overall increased speedup for that part s can be calculated as...
    a) $\frac{s}{(P+1)-\frac{1}{s}}$
    b) $\frac{1}{(1-P)-\frac{P}{s}}$
    c) $\frac{1}{(1-P)+\frac{P}{s}}$
16. 85% of a program can be parallelized and it was made 5 times faster. According to Amdahl's law, the overall speedup is...
    a) | |