UiT
THE ARCTIC
UNIVERSITY
OF NORWAY

EXAMINATION QUESTION PAPER

Exam in:	INF-3201
Date:	November 29th, 2017
Time:	09:00 – 13:00
Place:	Adm.bygget, B.154
Approved aids:	- English dictionary - English-Norwegian/Norwegian-English dictionary
Type of sheets (sqares/lines):	
Number of pages incl. cover page:	3
Contact person during the exam:	Phuong H. Ha
Phone:	413 45624

NB! It is not allowed to submit rough paper along with the answer sheets. If you do submit rough paper it will not be evaluated.

Please give short and concise answers. State explicitly any assumptions you do.

1) Message-passing computing (10%)

a) What separates a non-blocking send from an asynchronous send in MPI?

b) What is collective communication in MPI?

2) Parallel computers (10%)

What are Flynn's classifications along the instruction and data dimensions? List all four (4) and describe them with a sentence.

3) Embarrassingly parallel computations (10%)

What are the requirements for a problem to be solvable with an embarrassingly parallel algorithm?

4) GPGPU/CUDA (10%)

What do the following terms mean in CUDA (OpenCL equivalent in parenthesis), and what is the relation between them:
"grid" ("NDRange"), "block" ("Work Group"), "thread" ("Work Item")

5) Partitioning and divide-and-conquer (10%)

What is the relationship between recursion and/or tree structures and divide and conquer?

6) Pipelines computations (10%)

What are the prerequisites for a problem being a candidate for being parallelized through a pipeline?

7) Synchronous computations (10%)

What is a synchronous iteration?

8) Programming with shared memory (15%)

a) What is “determinacy race”?

b) What is Amdahl’s law? If the serial fraction of an application is 20%, what is the maximum speed-up of the application?

c) Let T^P be the execution time of an application on P processors. Using Cilk++ to analyze an application, we get $T^1 = 24$ (i.e. work) and $T^\infty = 6$ (i.e. span). What is the

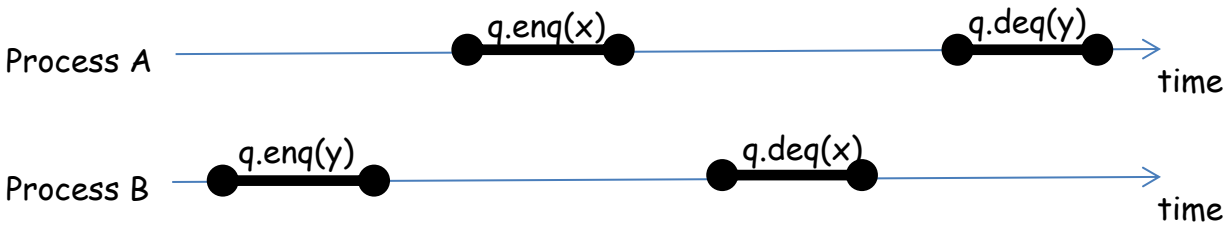
maximum speed-up of the application on 8 processors? Explain your answer using the work law and the span law.

9) Concurrent objects (15%)

Two processes *A* and *B* access a shared first-in first-out (FIFO) queue *q* as shown in the figure below. In the execution, process *B* enqueues *y* before process *A* enqueues *x*, and process B dequeues *x* before process A dequeues *y*.

a) Is this execution sequentially consistent? Explain.

b) Is this execution linearizable? Explain.



Good luck!