MÄLARDALEN UNIVERSITY
School of Education, Culture and Communication
Division of Applied Mathematics
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EXAMINATION IN MATHEMATICS
MAA313 Simulation, TEN1
Date: June 12, 2012 *Start:* 14.10
Aids: Pen, ruler, eraser, calculator

Till skrivvakten: det ska ges information på engelska i skrivningslokalen. Det ska vara linjerat papper som ska delas ut i skrivsalen.

This exam consists of five problems, each of which is worth 4 points. Marks:

Points	ECTS mark	Swedish mark
20	A	VG
18–19	B	VG
15–17	C	G
12–14	D	G
9–11	E	G

1. The Monte Carlo estimate of the option price is 1 euro. The variance of the estimate is 4, the number of simulations is 100, and $z_{0.025} = 1.96$. Calculate the 95% confidence interval for the option price.

2. Let $p \in (0,1)$. A random variable X has the following distribution: $\mathsf{P}\{X = 0\} = p$, $\mathsf{P}\{x = 1\} = 1 - p$. Describe an algorithm to simulate X.

3. Let $0 = t_0 < t_1 < \cdots < t_n$ be a fixed set of points. Describe the algorithm of simulation of the Brownian motion with drift r and diffusion coefficient σ^2 on the above set.

4. Prove that the control variate estimator is consistent.

5. Are the following intervals elementary in base 3? Explain.

   a) $[1/2, 1)$ (1 p.) **b)** $[1/3, 2/3)$ (1 p.) **c)** $[0, 1/27)$ (1 p.) **d)** $[1/9, 1/3)$ (1 p.)

Good luck!