MÄLARDALEN UNIVERSITY
School of Education, Culture and Communication
Division of Applied Mathematics
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EXAMINATION IN MATHEMATICS
MAA313 Simulation, TEN1
Date: March 29, 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 5 dollars. The variance of the estimate is 1, the number of simulations is 100, and $z_{0.025} = 1.96$. Calculate the 95% confidence interval for the option price.

2. A random variable X has exponential distribution with cumulative distribution function

$$F(x) = \begin{cases} 0, & x \le 0, \\ 1 - e^{-\lambda x}, & x > 0. \end{cases}$$

   Simulate X by inverse transform method.

3. Let $0 = t_0 < t_1 < \cdots < t_n$ be a fixed set of points. Describe the algorithm of simulation of the standard Brownian motion on the above set.

4. Calculate the expected value of the control variate estimator (1 p.) Calculate the variance of the above estimator (3 p.)

5. Are the following intervals elementary in base 2? Explain.

   a) $[1/2,1)$ (1 p.) **b)** $[1/4,3/4)$ (1 p.) **c)** $[1/3,2/3)$ (1 p.) **d)** $[-1/2,0)$ (1 p.)

Good luck!