



# Sample Quant Exam

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The following is a selection of questions that represent the type of question we have on our written quant exam, that we've asked at interview, or that we think are fun. Our goal is to help you, the prospective candidate, decide whether you might be suited to working for us, and give a guide to help you prepare.

Not all candidates will be familiar with every topic that appears here - if you're strong in most of these areas, but weak in one or two, we'd still like to meet you.

1. Suppose that  $X$  and  $Y$  are mean zero, unit variance random variables. If least squares regression (without intercept) of  $Y$  against  $X$  gives a slope of  $\beta$  (i.e. it minimises  $\mathbb{E}[(Y - \beta X)^2]$ ), what is the slope of the regression of  $X$  against  $Y$ ?
2. I meet someone with 2 children, and I learn that one of the children is a boy.  
What's the probability that the other child is also a boy? What if one of the children is a boy born on a Tuesday?
3. A stock has beta of 2.0 and stock specific daily volatility of 2%. Suppose that yesterday's closing price was \$100 and today the market goes up by 1%.  
What's the probability of today's closing price being at least \$103? What's the probability that the closing price is at least \$110?
4. If I break a stick of unit length into three random pieces, what's the expected length of the largest piece?

5. What is the Delta of an at-the-money binary option with a payoff 0 at  $< \$100$ , and payoff 1 at  $\geq \$100$ , as it approaches expiry?
6. (You probably need to look up numbers for this.) Suppose the moon were to disintegrate, and fall to earth over 5000 years. How does this influx of power compare to that of the Sun? Much more, about the same, or much less?
7. Consider all 100 digit numbers, i.e. those between 0 to  $10^{100} - 1$ , inclusive. For each number, take the product of non-zero digits (treat the product of digits of 0 as 1), and sum across all the numbers. What's the last digit?
8. Let  $R(n)$  be a random draw of integers between 0 and  $n - 1$  (inclusive). I repeatedly apply  $R$ , starting at  $10^{100}$ . What's the expected number of repeated applications until I get zero?
9. How many ways are there to tile dominos (with size  $2 \times 1$ ) on a grid of  $2 \times n$ ? How about on a grid of  $3 \times 2n$ ?
10. I have \$50 and I'm gambling on a series of coin flips. For each head I win \$2 and for each tail I lose \$1. What's the probability that I will run out of money?
11. **(Hard)** A company has a competition to win a car. Each contestant needs to pick a positive integer. If there's at least one unique choice, the person who made the smallest unique choice wins the car. If there are no unique choices, the company keeps the car and there's no repeat of the competition. It turns out that there are only three contestants, and you're one of them. Everyone knows before picking their numbers that there are only three contestants. How should you make your choice?