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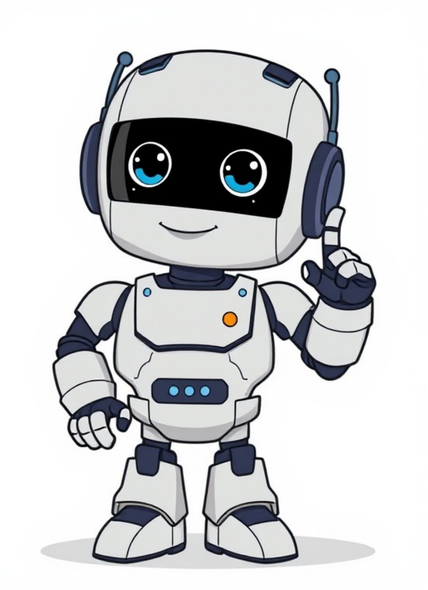

Random process and stochastic process are completely interchangeable (at least in many books on the subject). Although once upon a time "stochastic" (process) generally meant things that are randomly changing over time (and not space). See relevant citations: In English the word "stochastic" is technical and most English speakers wouldn't know it, whereas, from my experience, many German speakers are more familiar with the word "Stochastik", which they use in school when studying probability. The word "stochastic" ultimately comes from Greek, but it first gained its current sense, meaning "random", in German starting in 1917, when Sergei Bortkiewicz used it. Bortkiewicz had drawn inspiration from the book on probability by Jakob (or Jacques) Bernoulli, Ars Conjectandi. In the book, published 1713, Bernoulli used the phrase "Ars Conjectandi sive Stochastice", meaning the art of conjecturing. After being used in German, the word "stochastic" was later adopted into English by Joseph Doob in the 1930s, who cited a paper on stochastic procsses written in German by Aleksandr Khinchin. The use of the term "random process" pre-dates that of "stochastic process" by four or so decades. Although in English the word "random" does come from French, I strongly doubt it ever meant random in French. In fact, it originally was a noun in English meaning something like "great speed". It's related to the French word "randonée" (meaning hike or trek), which is still used today. To describe a random variable, French uses the word "aléatoire", stemming from the Latin word for dice (which features in a famous quote "Alea iacta est." by Julius Caesar). The English equivalent "aleatory" is not commonly used (at least in my random circles). A stochastic process is a way of representing the evolution of some situation that can be characterized mathematically (by numbers, points in a graph, etc.) over time. They are of greatest help when you either don't know the exact rules of that evolution over time, or when the exact rule of that evolution is too complicated or costly to compute precisely. Instead of trying to compute the exact evolution of the system, you use a source of randomness to help you describe the situation and its evolution. Then, using the laws of probability, you may be able to compute an expected behavior over time, the probability that something desirable happens, whether the situation leads to some stable state, etc. A typical concrete example is the length of a queue waiting for a cashier over time. Knowledge of the exact evolution of this number over the day could come in handy to the administrators, but they don't have exact knowledge of What makes people come at the exact times that they do, or How many items they will bring, or Any exceptional situations which could slow down the cashier. If the number of people in the queue at time t is N_t, then we could consider each N_t to be a random variable, because we don't know for sure what will happen at that moment. Randomness does not necessarily imply chaotic or "crazy" behavior, it can also obey its own laws. For example, if $N_t=5$, then we expect it to stay at 5 in the moments following t until someone arrives or leaves the queue at some time $t+s$, and then it can only jump to the values $N_{t+s} = 6$ or 4. In this case, something similar to a birth and death process could represent the situation. In this process there is randomness only in the amount of time that passes between changes in the state of N and in the direction in which the state changes (± 1); not in its magnitude. Of course, in order for a stochastic process to accurately represent a given situation, its underlying assumptions must me compatible with the situation, even if only as an approximation. The modeling process may involve estimating parameters, testing hypotheses, etc. Famous examples of stochastic processes are Brownian motion, random walk, the Black Scholes model for financial derivatives and the Poisson process. Stochastic calculus relies heavily on martingales and measure theory, so you should definitely have a basic knowledge of that before learning stochastic calculus. Basic analysis also figures prominently, both in stochastic calculus itself (where limit procedures of various kinds appear, as well as the occasional Hilbert or L^p space argument) and in martingale theory itself. Summing up, it would be beneficial for you to first familiarize yourself with elementary mathematical tools such as: -Real analysis (e. g., Carothers "Real analysis" or Rudin's "Real and complex analysis") -Measure theory (e. g. Dudley's "Real analysis and probability", or Ash and Doleans-Dade's "Probability and measure theroy") and furthermore learn basic probability theory such as -Discrete-time martingale theory -Theories of convergence of stochastic processes -Theory of continuous-time stochastic processes, Brownian motion in particular This is all covered in volume one of Rogers and Williams' "Diffusions, Markov processes and martingales", and also sporadically in the two probability-related books above by Dudley and Ash and Doleans-Dade. With a background like that, you should be well prepared to learn stochastic calculus, which you can do from volume two of Rogers and Williams' "Diffusions, Markov processes and martingales", or Karatzas and Shreve's "Brownian motion and stochastic calculus". A time series is a sequence of actual, fixed, values, like: 61, 63, 58, 64, 56, 48, 39, 42, ... A stochastic process is a sequence of random variables that have some kind of specified correlation or other distributional relationship between them. Stochastic processes are often used in modeling time series data- we assume that the time series we have was produced by a stochastic process, find the parameters of a stochastic process that would be likely to produce that time series, and then use that stochastic process as a model in predicting future values of the time series. i think unfortunately there is no such reference like a bible for stochastic calculus. In my experience this topic makes use of several theories, and each of them has entire books on the topics. But some books bring ###ARTICLELooking forward to sharing some references used in my master's degree in mathematical methods for finance, particularly for studying stochastic calculus. As part of a practical approach, if you're interested in pure mathematics, consider exploring measure and integration theory and analysis further. For more applied aspects, I recommend Stochastic Calculus for Finance I: Binomial asset pricing model and Stochastic Calculus for Finance II: Tochastic Calculus for Finance II: Continuous-Time Models. These two books are excellent for applying the theory to price derivatives. I also found Bernt Oksanda's book on Stochastic Differential Equations: An Introduction with Applications to be a valuable resource, although I think it has more challenging math than Sherevs' book. The extra exercises and solved problems in this book have been particularly helpful when getting stuck. Another useful resource is Brownian Motion Calculus by Ubbo F Wiersema, which offers a practical approach with plenty of problems to solve, theorems' proofs, and practical applications. In addition to these books, I've found some great free courses online, such as Advanced stochastic processes from MIT open course and Introduction To Stochastic Processes. These courses have video classes that are very informative. There are also some excellent YouTube channels, like quantpie, that provide clear explanations of stochastic calculus concepts. For a pure mathematical approach, I recommend FOLLAND's Real analysis: modern techniques and their applications, ROYDEN's Real Analysis, and BARTLE's The elements of integration and Lebesgue measure. Keep in mind that these books are at my current level of knowledge, which is much lower than that of an experienced specialist, such as a PhD in the field.