Statistics 222, Spatial Statistics.

<u>Outline for the day:</u>

1. Review list.
2. Review oldexam.
3. More exercises.

Review list.

1. PP as a random measure.
2. Integration, $\int f(t,x,y)\, dN$.
3. Simple and orderly.
4. Cond. intensity and Papangelou intensity.
5. Poisson processes.
6. Mixed Poisson processes.
7. Compound Poisson processes.
8. Poisson cluster processes.
9. Cox processes.
10. Gibbs and Strauss processes.
11. Matern processes.
12. Hawkes and ETAS processes.
13. Likelihood and MLE.
14. Covariance and variogram.
15. Kriging.
16. CAR, SAR models.
17. Simulation by thinning.
18. Martingale formula.
19. Kernel smoothing.
20. F,G,J,K, and L functions.
21. Marked G and J functions.
22. Weighted K function.
23. Nonparametric triggering function est.
24. Deviance, Voronoi, and superthinned residuals.

What you need to know for the exam.

I will put the exam online at http://www.stat.ucla.edu/~frederic/222/S20 in a file called myexam.pdf this Thu at 930am pacific time exactly.

You need to email me with your name and your responses by 1045am to frederic@stat.ucla.edu .

You can use any notes or books you want.

10 multiple choice questions. They are all worth the same amount but some might be harder than others.

None of the above.

X is a Poisson RV with mean 10. What is Var(X)?

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You need to know the very basics of integrals, like $\int(f(x)+g(x))dx = \int f(x)dx + \int g(x)dx$ and be able to compute the integral of f(x) dx, where f(x) is

$f(x) = c$, or $f(x) = \log(x)$, or $f(x) = x^a$ where a is an integer, or $f(x) = e^{ax}$.

What is $\int_1^3 \int_1^3 (4+3/x)\, dx\, dy$?

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$f(x) = c$, or $f(x) = \log(x)$, or $f(x) = x^a$ where a is any real number, or $f(x) = e^{ax}$.

What is $\int_1^3 \int_1^3 (4+3/x)\, dx\, dy$?

$2(4x + 3\log(x)]_1^3) = 12 + 3\log(3) - 4 - 3\log(1) = 8 + 3\log(3)$.

3. More review questions.

For an Ornstein-Uhlenbeck process, a 2nd-order stationary process with covariance function

$$\rho(h) = \exp(-\beta|h|)/2\beta.$$

What is the corresponding semivariogram? What are the nugget, sill, and partial sill?

3. More review questions.

For an Ornstein-Uhlenbeck process, a 2nd-order stationary process with covariance function

$\rho(h) = \exp(-\beta|h|)/2\beta$, for all h, where $\beta > 0$.

What is the corresponding semivariogram? What are the nugget, sill, and partial sill?

Use the fact that $\gamma(h) = \rho(0)-\rho(h)$. See p15 of van Lieshout.

$\gamma(h) = 1/2\beta - \exp(-\beta|h|)/2\beta$.

The nugget effect is $\lim_{h\to 0} \gamma(h) - \gamma(0) = 0$.

The sill is $\lim_{h\to\infty} \gamma(h) = 1/2\beta$.

The partial sill is $\lim_{h\to\infty} \gamma(h) - \lim_{h\to 0} \gamma(h) = 1/(2\beta)$.

3. More review questions.

Which of the following is not true regarding the differences between a CAR model, a SAR model, and kriging?

a. For a CAR model, the errors are correlated with each other, whereas with SAR the errors are uncorrelated.

b. For a CAR model, the errors at one location are uncorrelated with the values of the random field at other locations, whereas with SAR the errors and the random field are correlated with each other.

c. With CAR and SAR, only neighboring values are used to predict a certain value of the random field, whereas kriging uses all the values and as a result under general conditions is optimal for prediction.

d. With CAR and SAR, typically the covariance function is zero unless two values are neighbors, whereas this is not typically assumed in kriging.

e. None of the above.

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d. With CAR and SAR, typically the covariance function is zero unless two values are neighbors, whereas this is not typically assumed in kriging.

e. None of the above.

3. More review questions.

Suppose a point process is generated on B = [0,10] days x [0,1] x [0,1]. First one generates parent points according to a stationary Poisson process with rate 0.3. Then each parent point gives birth to exactly one child point independently with probability 1, and it is placed uniformly within 1 day after the parent and anywhere in the unit square. The resulting process consists of both the parents and children points.

One realization of this process results in two points, one at (3, 0.4, 0.5) and another at (3.5, 0.7, 0.8). What is the loglikelihood, L?

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One realization of this process results in four points, at (3, 0.4, 0.5), (3.4, 0.7, 0.8), (7.2, 0.4, 0.5), and (7.5, 0.9,0.1). What is the loglikelihood, L?

$L = \sum \log(\lambda) - \int \lambda(t,x,y)\, dt\, dx\, dy$

$= \log(.3) + \log(1.3) + \log(.3) + \log(1.3) - 0.3 \times 10 - 2$

$\sim -6.883.$