APPLIED STATISTICS EXAM

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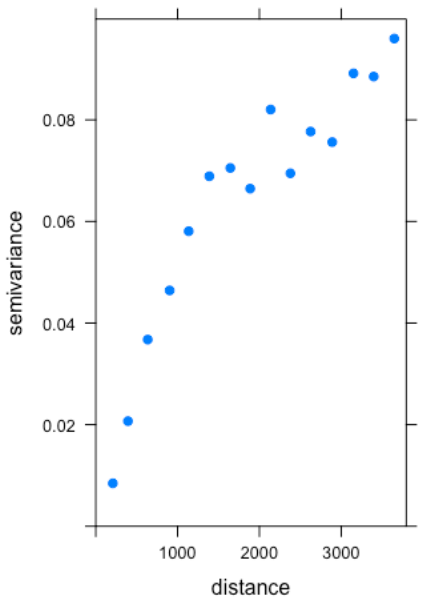
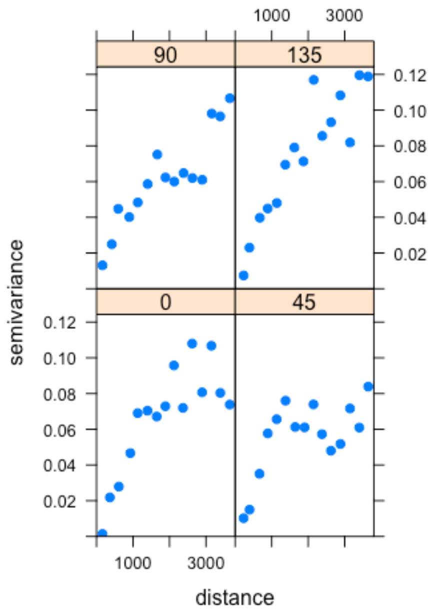
EXERCISE NUMBER 4

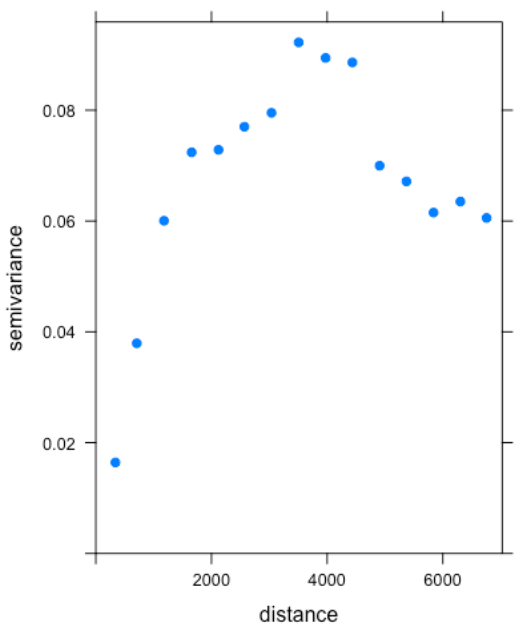
POINT A)

After checking for isotropy I fit a variogram model.



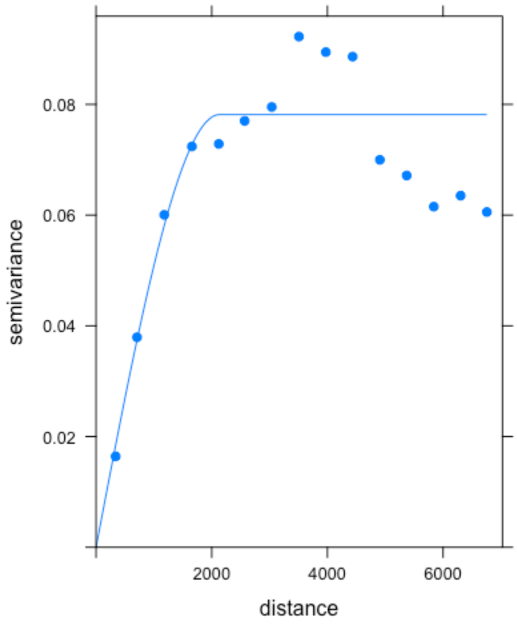


To assume isotropy is a bit of a stretch, but I can assume it more or less. Also the variogram doesn't seem to stabilize well so I try to extend the cutoff and see if it stabilizes further:



The variogram seems to stabilise.

Here is the fitted variogram



The model estimated fot delta(sk):

model psill range

Sph 0.07815743 2136.622

The parameters estimated via GLS are:

Alpha0 (2003): 35.66404

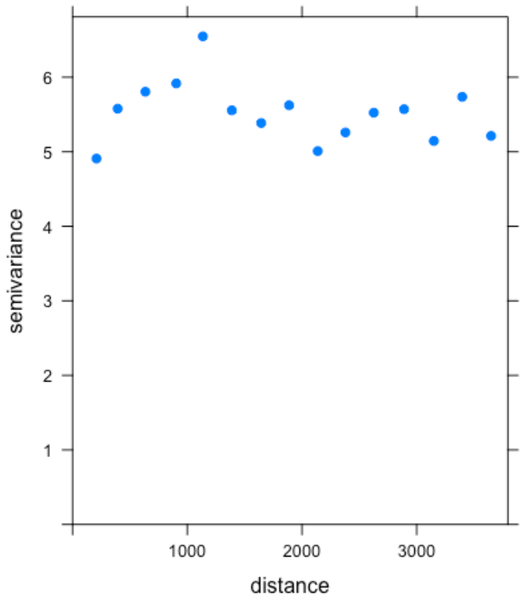
Alpha1 (2022): 30.98347

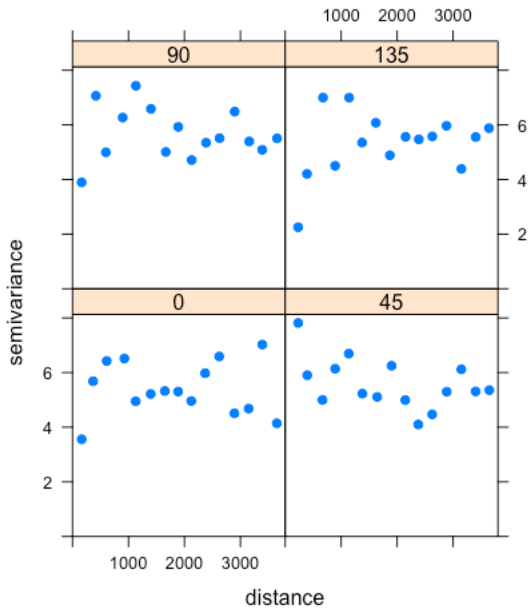
The universal Kriging model assumes z_s = m_s + delta_s for any s in D (domain) where m_s is called drift and describes the non constant spacial mean variation. Moreover we assume E[delta_s] = 0 for any s in D (so that E[z_s] = m_s) and that Cov(z_s1,z_s2) = Cov(delta_s1,delta_s2) for any pair.

We also assume that C(•) is known (we estimate it) and that m_s follows a linear model m_s(t) = sum_l=0^L a_l(t) f_l(s) for s in D and t in T, where f are known functions of s and a_l are coefficients independent from the spacial location.

POINT B)

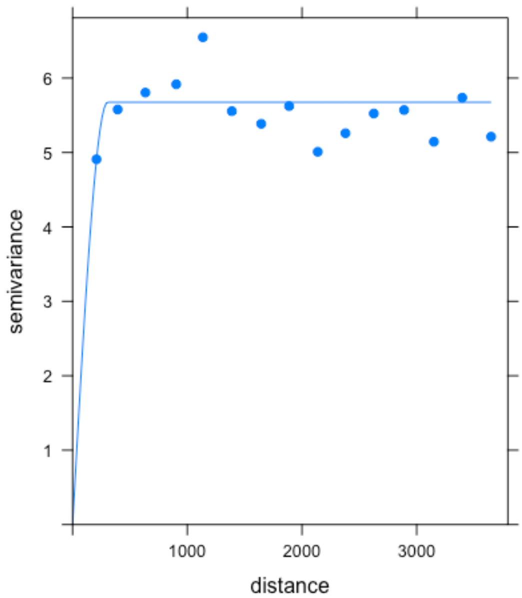
After checking for isotropy I fit a variogram model.





Isotropy is assumed, and the variogram stabilises well since the beginning.

Here is the fitted variogram (which clearly isn't the best fit for the data):



The model estimated fot delta(sk):

	model	psill	range
1	Sph	5.675135	305.2353

The parameters estimated via GLS are:

Beta0 (park=0): 33.38337

Beta1 (park=1): 33.21578

The universal Kriging model , as before, assumes z_s = m_s + delta_s for any s in D (domain) where m_s is called drift and describes the non constant spacial mean variation. Moreover we assume E[delta_s] = 0 for any s in D (so that E[z_s] = m_s) and that Cov(z_s1,z_s2) = Cov(delta_s1,delta_s2) for any pair.

We also assume that C(•) is known (we estimate it) and that m_s follows a linear model m_s(t) = sum_l=0^L a_l(t) f_l(s) for s in D and t in T, where f are known functions of s and a_l are coefficients independent from the spacial location.

POINT C)

I am using universal kriging assumptions.

Clearly the model at point A is more appropriate to fit the data: although the variogram stabilizes in both and isotropy can be assumed in both, the second model doesn't fit a spherical model without nugget, since it stabilizes immediately and with a high psill. It would fit more appropriately a pure nugget type of model, which in practice means no spatial correlation, and stationarity.

Moreover, it makes sense to distinguish temperatures recorded in different years, since global temperatures have probably been increasing everywhere: using only park mixes temperature recorded in very different timeframes, which are probably not so much as spatially correlated between the years.

POINT D)

The prediction for the temperature requested using model at point a) is

31.24826 (using universal kriging)

With var of the prediction = 0.02182844