Optional Technical Homework Due October 15

What should you do if you want to conduct a trend analysis but the spacing between intervals is unequal?

New coefficients can be obtained that adjust for the unequal spacing but are still mutually orthogonal. The math is complicated so use a computer program You could use orthogonal trend coefficients for equally spaced observations that we have used so far in this class but might not be exact.

Below is a SAS program to find orthogonal polynomials when there is unequal spacing between the levels of the quantitative independent variable. The first example is from a study where independent samples of subjects were measured when an intervention started (0), 3, 9,12, and 18 months after an intervention. The second example is from a hypothetical dosage study with unequal intervals between dosages.

The iml program is a matrix programming language in SAS. Note that orpol is the command to calculate orthogonal polynomials. The first character is the name of the vector of time points. The number indicates the degree of the polynomial that you want. For the first example the orpol procedure will find the four polynomials for the data in vector t. The output of the orpol procedure is in the matrix m4. For the dosage example, the six orthogonal polynomials for vector d are put in matrix m6. The print command prints the matrices listed.

```
proc iml;
*Example from Intervention Study;
t={0 3 9 12 18};
m4=orpol(t,4);
print m4;
*Example of unequal spacing in a Dosage Study;
d={0 .15 .30 .50 .70 1.1 1.5};
m6=orpol(d,6);
print m6;
run;
```

The polynomials are orthogonal to each other. The sum of each squared coefficient for each trend comparison is equal to one. The linear, quadratic, cubic, and quartic orthogonal comparisons are the second, third, fourth, and fifth columns respectively. The first column corresponds to the contrast of all ones that was used to set up contrasts using the special command in SPSS.

Print out of matrix call m4:

	Linear	Quadratic	Cubic	Quartic
0.4472136	-0.586395	0.480658	-0.440204	0.1769981
0.4472136	-0.376969	-0.092434	0.6847624	-0.424795
0.4472136	0.0418854	-0.536119	0.0978232	0.7079923
0.4472136	0.2513123	-0.406711	-0.538028	-0.530994
0.4472136	0.6701663	0.5546054	0.1956464	0.0707992

So the linear comparison would have the following coefficients: -.586395, -.376969, .0418854, .2513123, .6701663. These are the coefficients that you would use to multiply each mean to find the linear comparison difference.

Print out of matrix m6 for the dosage study:

m6

0.3779645	-0.461317	0.5133196	-0.44375	0.3639074	-0.208508	0.0895237
0.3779645	-0.347344	0.1572169	0.1535523	-0.441208	0.564022	-0.418825
0.3779645	-0.233372	-0.119339	0.388643	-0.352268	-0.245226	0.6731766
0.3779645	-0.081409	-0.36434	0.2983428	0.2181246	-0.523783	-0.553928
0.3779645	0.0705543	-0.467924	-0.052643	0.5397016	0.5323945	0.2360489
0.3779645	0.3744805	-0.250842	-0.660676	-0.443487	-0.141324	-0.028988
0.3779645	0.6784067	0.5319079	0.3165307	0.115229	0.0224239	0.0029919

1. Turn in the print out of the above program.

2. A study was conducted with the following times of observation, 0, 3 years, 10 years, and 20 years. Find orthogonal polynomials.

3. Demonstrate that two of the comparisons for the intervention study are orthogonal.

4. Find orthogonal polynomials for 1, 3, 5, 7 times. Compare to the trend coefficients in Keppel on page 520 to the ones printed out by SAS iml.