Today

• Ex. 3 solution
• 2D spatial interpolation (theory)
• Pause
• Effects toolbar
• Interpolation in ArcGIS (examples)
• Away March 31 and April 2
• On Thursday - Intro to ArcScene?
Ex. 3 - Many Peaks

- Where to build a lodge?
  - has a view of as many peaks as possible
  - viewshed analysis uses canopy (elevation + trees)
  - also: need flat ground (< 5 deg. slope)
- possible cell values in initial viewshed: 0 to 10 (# of peaks)

There are 8 cells with 9 views and 1 with 10 views.
• reclassify to 0-8 => 0, 9-10 => 1
• show cells with 1 with good contrast
• use Identify tool to get slope, azimuth, coordinates
• Create final map (with hillshade and 50 ft contours)

5) There should be a few of these “9 or more views” cells. Decide on one of these cells that has less than 5 degrees slope and mark it with a circle. What are the UTM coordinates, elevation, the slope and the direction (aspect) for this cell (4 pts)

UTM coordinates: 608,479,203  4,911,015,983
Elevation: 1,728 m.
Aspect: 174.8 degrees or Southeast Slop is less than 5 degrees

6) Make a final map to present this “best” proposed site to your boss. Combine the DEM (your pick of color map), with the hillshade and the contours and the peaks (with labels) (6 pts)
Green for low elevations? contours in black?
• Optional: Find out which (9) peaks are in sight from lodge
• Add lodge to summits point shape file (as FID=15)
• Run Observer points tool ( => new observer grid)
• Identify tool - what’s value of observer grid at lodge location?
• Look up value in observer grid’s attribute table
• Get all OBSxx with 1 (summit can see lodge and vice versa)
• Figure out which OBSxx is which peak name
• Select and show on map (or use special symbol)
Spatial Interpolation

- point samples \((x, y, \text{"value"})\)
- fill each cell (center) in raster with an “appropriate” value
- Principle: the closer together points are, the more similar their value (should be)
- (depends on many factors: type of underlying phenomenon, etc.)
- Examples?
- in general: distance **and** sample value matter
Thiessen (Voronoi) polygons

- Interpolation? Space division scheme?
- Assign each sample “its fair share” of space around it
- Raster: fill this space (polygon) with **same** value
- Problem?
(Thiessen polygons: not in spatial analyst but keep in mind for later)
Moving “Averaging”

- Simple form: grab all the point samples within the sample radius
- Cell value is Sum of these points’ values divided by their number (mean)
- Problem?
- (interpolated value at sample location?)
Related topic: point density

- NOT a value interpolation scheme!
- How dense are the samples together?
- simply **count** all the point samples within the “circle”, divide by circle’s area
- “kernel” method: different math, smoother
Housing Density

...the Point Density technique passes a “roving window” over a project area calculating the total number of houses within a specified distance.
Inverse Distance Weighted (IDW) interpolation

- grab all the point samples inside a radius

- When calculation the cell’s value, take the sample distances into account (“weight”)

- Weight of each sample point is an inverse proportion to its distance to the cell

- The further away the point, the less the weight it gets (contributes less)

- effect of exponent (1,2,3, ..)?

\[ Z_j = \frac{\sum Z_i}{\sum \frac{1}{d_i^n}} \]

\( Z_i \) is value of known point
\( D_{ij} \) is distance to known point
\( Z_j \) is the cell value (unknown)
\( n \) is a user selected exponent or power (often 1,2 or 3)

exponent n is 1 here!
• Higher exponents: less weight to distant points (point that are farther away)

• (closer point are more important)

• Use more samples: “smoother” distribution

• interpolated value at sample location?

“linear”: exponent = 1
“square”: exponent = 2
IDW: search radius

- **variable** search radius:
  grab n (12) closest points, up to a distance of d (default 0, => no distance limit)

- **fixed** search radius:
  grab ALL points within a distance of (250) units, use at least n points (default 0, => use all)
IDW: using break lines

• line features to limit (block) point “grabbing”
• samples “from the other side” of the break line will NOT be used
• use for: ridges, faults, ...
• Caveats: much slower, some NoData values (extrapolation issues?)
Splines

- smooth surface, non-exact
- based on minimizing curvature
- rubber sheet “bent” around samples
- can over-shoot / under-shoot
- ArgGIS: 2 types - regularized and tension
- ArcGIS: Weight - smoothness “tweak” factor
- gotcha: both have different meaning of weight
- tension (0.1 - 15): low = smooth, high = coarse

IDW: squared, 12 nearest points

Spline
IDW:

Spline
Interpolation class exercise

- new ArcMap, add `elev_pts_samples_100` from `geo1588\data`
- 100 random points, elevation extracted from `dem_steep` with `Extract by Points` tool
- IDW fixed: fixed search radius 5000 m
- IDW variable: variable search radius (12 pts)
- Tension spline, weight 0.1
- Tension spline, weight 10
- Color all with Temperature (spectral) color ramp (smooth)
- Activate **Effects** tool - compare results
- compare to “true” data (`dem_steep`)