* MVU Module/Slide Notes
  + "Polynomial Regression": <https://en.wikipedia.org/wiki/Polynomial_regression> [Links to an external site.](https://en.wikipedia.org/wiki/Polynomial_regression)

 "Spline": <https://en.wikipedia.org/wiki/Spline_(mathematics)>

 [Links to an external site.](https://en.wikipedia.org/wiki/Spline_(mathematics))

* +  "Generalized Additive Model": [https://en.wikipedia.org/wiki/Generalized\_additive\_model Links to an external site.](https://en.wikipedia.org/wiki/Generalized_additive_model)
* Intro to Statistical Learning with R (ISLA)
  + Chapters 7, Section 7.1-7.2, pages 266-270
    - Polynomial regression = higher order terms (squares, cubes etc.)
      * Usually no higher than order 4
    - Step function: cutting range into K regions. This produces a qualitative variable and makes piecewise CONSTANT functions
    - Regression Spline: poly + step. X range is split into K regions but each region can have a polynomial function. Constrained such that the functions join smoothly at the boundaries of K bins called “knots”.
      * Achieve smoothness by ensuring the 1st and 2nd derivative of the curves are also continuous at the knots.
      * Piecewise polynomial of degree d should have continuity in the derivatives up to d-1.
    - Smoothing spline
    - Local regression: spline but regions are allowed to overlap in a smooth way
    - Generalized Additive Models (GAMs): add everything above to deal with multiple predictors.
  + Chapters 7, Section 7.4-7.5, pages 271-279
    - Spline values can get wild at the extremes (x<smallest knot or >largest knot
      * Natural splines impose further constraint that curve must be linear at the boundaries
    - Difference between degrees of freedom and the order of the polynomial
  + Chapters 7, Section 7.7, pages 282-286
    - Multiple linear regression on steroids. Everything previously only dealt with single predictor X (even if we pushed it to higher orders). Now we want to make predictions using multiple predictors (X, Z, W, V etc.)
    - Generalized Additive Models (GAMs) can predict quantitative or qualitative Y’s
    - Basically compute separate functions for each predictor and then add them all together
    - Smoothing spline imposes a penalty factor to control smoothness