

John Little – This is a preliminary draft of course descriptions proposed for the 2015-2016 CHQ Cluster. As you will see, these are quite heavily slanted toward the “origin/journey/destination” form of the cluster theme.

### *Mathematical Journeys*

#### *Fall – From the Known into the Unknown*

Is it surprising to learn that new facts and techniques are constantly being added to our mathematical knowledge? That is the case, but how does it happen? And what does it take for a new statement of fact to be accepted? The standard of mathematical truth is based on deductive proof. Since these proofs make crucial use of what is already known, attempting to construct one can be seen as a journey from the known into the unknown, a journey that (if successful) stakes a claim to previously unknown territory and makes it known. Mathematicians would say that these journeys can be even more important than the destinations. But what does it take to find a proof, and how does this relate to the mathematics you have learned, which probably concentrated more on practical applications (the destination) than on this sort of journey? We will take a close look at some important sources, including Book I of Euclid’s *Elements*, and begin to understand how mathematics is developed and communicated via proofs. No background beyond high school geometry and algebra is required for this course, but openness to new points of view and a willingness to think deeply about mathematical ideas will be helpful.

#### *Spring – From the Unknown to the Known*

How likely are we to see Joe DiMaggio’s 56-game hitting streak surpassed in our lifetimes? Does a high-fat diet lead to increased risk of certain cancers? Finding answers to such questions can be seen as journeys from the unknown to the known. But what is the relation to the mathematical journeys we undertook in the fall when there is such a large element of chance and randomness involved? The connection is that mathematical theories of probability and statistical inference, together with solid understanding of how and why they actually work, allow us to draw reasonable conclusions about the unknown. Moreover, the requisite level of understanding is based on the same sort of mathematical reasoning we studied in the first semester. We will take a detailed and occasionally critical look at the ways reasoning about probabilities is used to identify patterns via statistics. In the process, you will develop an appreciation of the power and the limitations of statistical thinking and learn to analyze claims backed by statistics.