1 Question 1

It is commonly assumed that agglomeration economies generate benefit to: i) the firms within a cluster and ii) the communities that 'house' the agglomeration. In both cases, provide detail on the nature of these advantages.

2 Question 2

Discuss possible conventional GIS modeling of some of your data variables (pp. 14-15 in your Proposal). This may include Overlay Combinations, Rules in Distance Relationships, Spatial Analysis using Continuous Fields and other functions, normally as part of GIS procedures (scripts). Allude to both (quantitative) Analysis and (qualitative) Visualization results. Specify the spatial scope for these models, e.g., within cities, regions (GTA, SW Ontario), or at coarse scales (Canada, USA, North America).

3 Question 3

Discuss the concept of spatial autocorrelation. Explain and critically evaluate that concept in the context of the spatial patterns of economic activities.

Spatial autocorrelation is at it's heart the application of Tobler's first law of geography: "everything is related to everything else, but near things are more related than distant things."(Tobler 1970, page 236). In other words, this concept test using probability on whether the characteristics of location A are similar (or dissimilar) to location B via distance lags. Significant results implies that spatial processes are at work. Furthermore, this underlying spatial pattern renders many classical statstics unreliable, since it violates the assumption of independence between observations.

There are four widely used measures of spatial autocorrelation: Joint count analysis, Moran's I, Geary's C and Getis- ord g statistic (also known in the literature as Hotspot Analysis or High/Low Clustering)

The simplest simplest test for spatial autocorrelation is joint count analysis (Lee and Wong 2000). This technique measures the strength of association of a phenomenon with regards to presence or absence of a binary attribute in adjacent polygons (ie sum of 1-1, 0-1, 0-0 interactions) vs an expected count that assumes the distribution of polygon counts is randomly distributed. As with many spatial techniques, this measure is sensitive to the border effect since unnecessarily large survey areas or unessessarily small polygons (using dissemination blocks for Canada-wide data location of Tim Hortons franchise locations) can artificially increase the effect of clustering. The reverse is also true, with too large a spatial aggregation reducing the power of the test to irrelevance (ie. using presence in forward sortation areas polygons).

While this method is simple (conceptually and mathematically), it's simplicity can make it a coarse instrument in some respects. For instance, the binary attribute (presence or absence), does not measure the strength of association, therefore a polygon with 1 instance is weighted the same as a polygon with 10 instances. In order to calculate this level of interaction, a more sophisticated measure will be needed, such as Moran's I statistic.

Moran's I, is more sophisticated than joint-count analysis, by allowing the use of points and polygons as well as the ability to use any continuous variable rather than binary data. The output of Moran's I measures the degree of correlation between the variable χ and the spatial lag of χ by averaging the value of χ in neighbouring regions as determined by the spatial weights matrix.

Furthermore, the spatial weights table is more customizable to the problem at hand than in Joint-Count Analysis. Most of the decision process in choosing the distance method for populating the spatial weights table will be influence by the literature. From the most naive (least subject knowledge/fewest assumptions), the spatial weights table can describe a basic agency matrix (1 or 0) using the rook's or queen's case when dealing with polygons, or in the case of point data, the nearness of the point to it's neighbours ($wij = 1/dij$ where the matrix is calculated as 1 over the distance of between points) for n-number of neighbours. The adjacency matrix can also be row standardized, or have a distance decay function such as exponential decay.

References

Lee, J. and D. W.-S. Wong (2000). *GIS and Statistical Analysis with ArcView.* John Wiley.

Tobler, W. R. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography 46*, pp. 234–240.