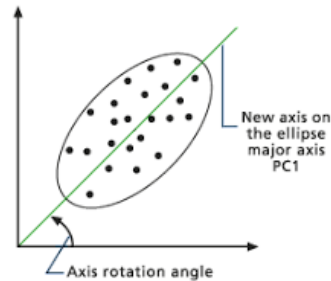# Lab 5: Principal Components Analysis



**Analyse the following problems in groups,**

1. Read and understand "A tutorial on Principal Components Analysis" by Lindsay I Smith.
2. Implement PCA algorithm (in R, Python, MatLab…) to solve the following problem:
   Table 1 provides the average price in cents per pound of five food items in 24 U.S cities[1].
   a. Identify the most and the least expensive cities (based on the above price index measures).
   b. Plot the data using principal components scores and identify distinct groups of cities. How are these groups different from each other?

**Submission**:
Summarise all the answers on a **one-page** document (per group). Your report can cover the following details but not limited to:
   a. Your group member, responsibility of each team member and contribution in percentage.
   b. Answers for Question 2.

**Deadline**: 9th November 2018

**DO NOT copy and paste from online resources.**

---

[1] [1]U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C., 1978.

Table 1: Food Price Data. Average price in cents per pound.

| City | Bread | Hamburger | Butter | Apples | Tomatoes |
|---|---|---|---|---|---|
| Anchorage | 70.9 | 135.6 | 155 | 63.9 | 100.1 |
| Atlanta | 36.4 | 111.5 | 144.3 | 53.9 | 95.9 |
| Baltimore | 28.9 | 108.8 | 151 | 47.5 | 104.5 |
| Boston | 43.2 | 119.3 | 142 | 41.1 | 96.5 |
| Buffalo | 34.5 | 109.9 | 124.8 | 35.6 | 75.9 |
| Chicago | 37.1 | 107.5 | 145.4 | 65.1 | 94.2 |
| Cincinnati | 37.1 | 118.1 | 149.6 | 45.6 | 90.8 |
| Cleveland | 38.5 | 107.7 | 142.7 | 50.3 | 83.2 |
| Dallas | 35.5 | 116.8 | 142.5 | 62.4 | 90.7 |
| Detroit | 40.8 | 108.8 | 140.1 | 39.7 | 96.1 |
| Honolulu | 50.9 | 131.7 | 154.4 | 65 | 93.9 |
| Houston | 35.1 | 102.3 | 150.3 | 59.3 | 84.5 |
| Kansas City | 35.1 | 99.8 | 162.3 | 42.6 | 87.9 |
| Los Angeles | 36.9 | 96.2 | 140.4 | 54.7 | 79.3 |
| Milwaukee | 33.3 | 109.1 | 123.2 | 57.7 | 87.7 |
| Minneapolis | 32.5 | 116.7 | 135.1 | 48 | 89.1 |
| New York | 42.7 | 130.8 | 148.7 | 47.6 | 92.1 |
| Philadelphia | 42.9 | 126.9 | 153.8 | 51.9 | 101.5 |
| Pittsburgh | 36.9 | 115.4 | 138.9 | 43.8 | 91.9 |
| St. Louis | 36.9 | 109.8 | 140 | 46.7 | 79 |
| San Diego | 32.5 | 84.5 | 145.9 | 48.5 | 82.3 |
| San Francisco | 40 | 104.6 | 139.1 | 59.2 | 81.9 |
| Seattle | 32.2 | 105.4 | 136.8 | 54 | 88.6 |
| Washington | 31.8 | 116.7 | 154.81 | 57.6 | 86.6 |