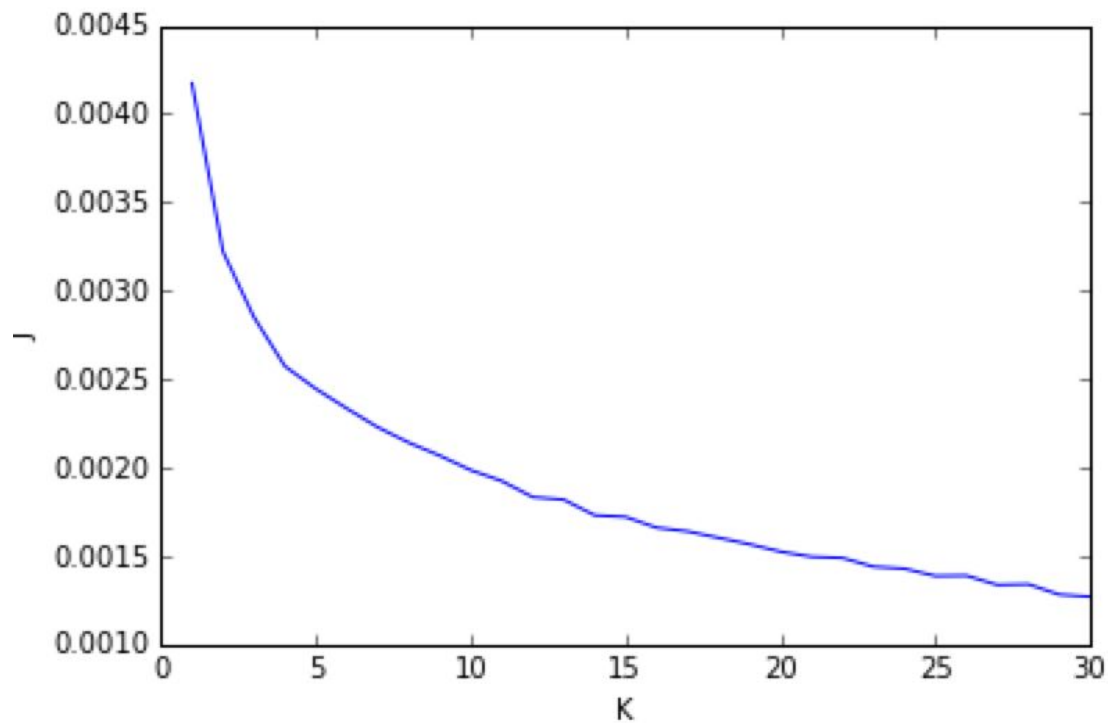
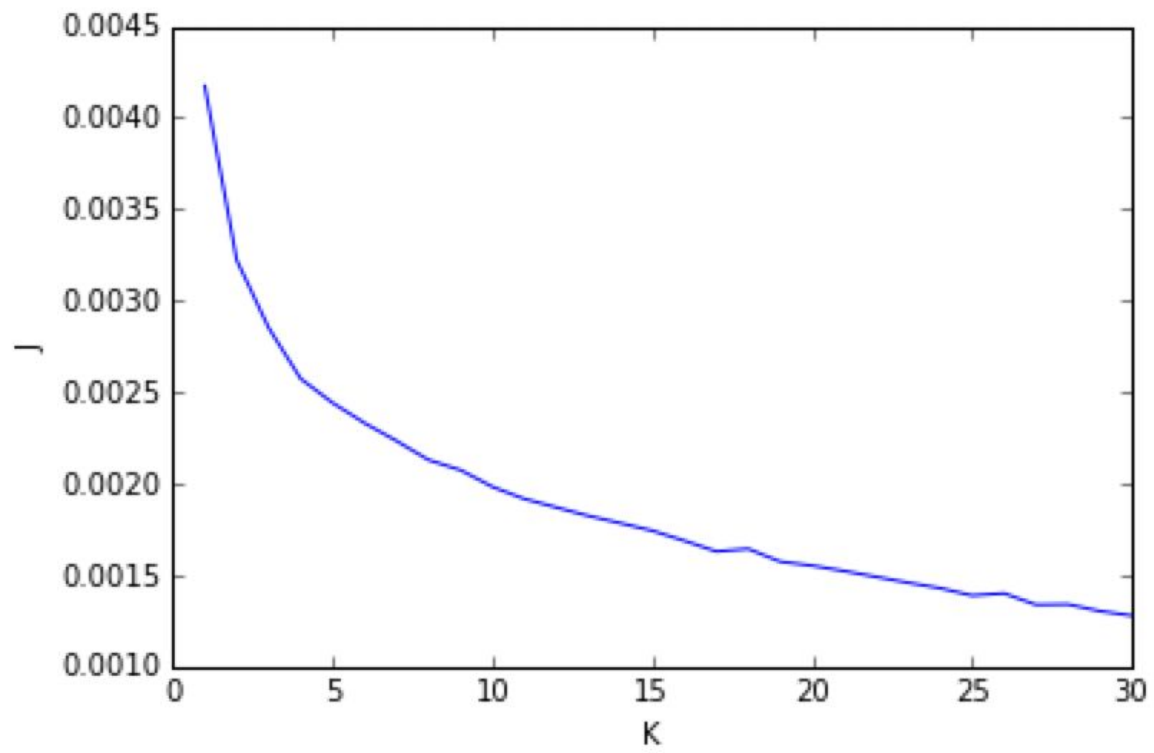


We ran our algorithm for $K=1-30$ for three different repetitions (100, 50, and 5) to see if our results varied for different repetitions. Looking at our plots of J vs. K , our results didn't vary based on the different number of repetitions.

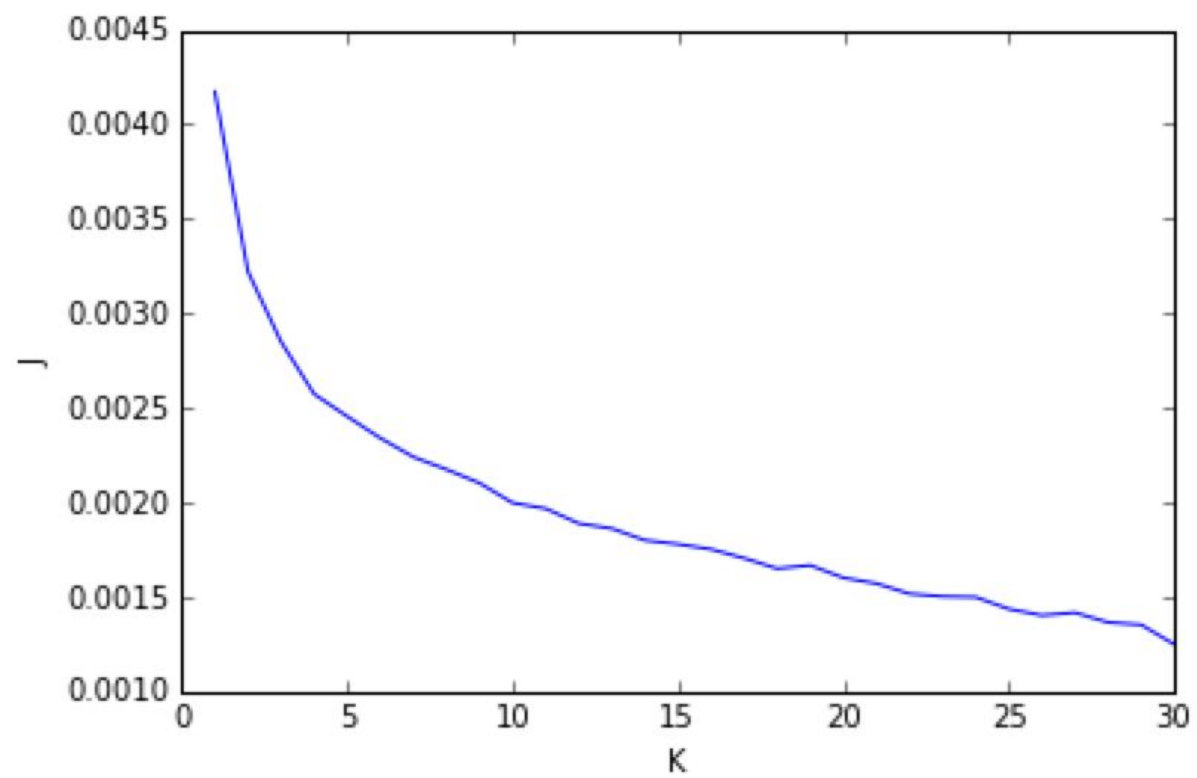
$k = 5$, $\text{rep} = 100$



k=5 , rep = 50



k=5 , rep = 5



We are picking $k = 4$ based on our plot, as this is the elbow of the plot. Beyond $k = 4$, there is diminishing returns on the decrease of J , so 4 is the best value of k .

We next ran our clustering algorithm with $k = 4$ and these were our results:

Cluster 1 Countries: ['Argentina', 'Barbados', 'Belarus', 'Belize', 'Bolivia (Plurinational State of)', 'Brazil', 'Brunei Darussalam', 'Bulgaria', 'Central African Republic', 'Chile', 'Colombia', 'Comoros', 'Costa Rica', 'Croatia', 'Cyprus', 'Democratic People's Republic of Korea', 'Dominica', 'Ecuador', 'El Salvador', 'Estonia', 'Greece', 'Guatemala', 'Guinea-Bissau', 'Guyana', 'Honduras', 'Hungary', 'Israel', 'Japan', 'Kazakhstan', 'Kenya', 'Latvia', 'Lithuania', 'Madagascar', 'Marshall Islands', 'Mauritius', 'Micronesia (Federated States of)', 'Niger', 'Panama', 'Papua New Guinea', 'Peru', 'Poland', 'Portugal', 'Republic of Korea', 'Republic of Moldova', 'Romania', 'Russian Federation', 'Saint Kitts and Nevis', 'Saint Lucia', 'Saint Vincent and the Grenadines', 'Samoa', 'Sao Tome and Principe', 'Senegal', 'Seychelles', 'Singapore', 'Slovakia', 'Slovenia', 'Solomon Islands', 'South Sudan', 'Spain', 'Suriname', 'Trinidad and Tobago', 'Turkey', 'Turkmenistan', 'Vanuatu', 'Venezuela (Bolivarian Republic of)', 'Viet Nam']

Cluster 1 Center: {'Action taken on climate change': 0.032674745615251667, 'Better transport and roads': 0.036973293145440754, 'Equality between men and women': 0.077059308389556061, 'Reliable energy at home': 0.072430025390300024, 'Access to clean water and sanitation': 0.095043196185957593, 'A responsive government we can trust': 0.027641335986489383, 'Support for people who can't work': 0.073231020960883339, 'Protecting forests rivers and oceans': 0.086085182826260598, 'Phone and internet access': 0.027930257814703024, 'Freedom from discrimination and persecution': 0.050068737357365153, 'Protection against crime and violence': 0.034991542256095465, 'A good education': 0.091991509044471204, 'Better healthcare': 0.11803578355924696, 'Country': 0.049299357178539401, 'Political freedoms': 0.057138181570203034, 'Affordable and nutritious food': 0.069406522719231825}

Cluster 2 Countries: ['Afghanistan', 'Andorra', 'Angola', 'Antigua and Barbuda', 'Armenia', 'Azerbaijan', 'Bahamas', 'Bahrain', 'Bangladesh', 'Benin', 'Botswana', 'Burkina Faso', 'Burundi', 'Cambodia', 'Cameroon', 'Chad', 'China', 'Cuba', 'Czech Republic', 'Democratic Republic of the Congo', 'Djibouti', 'Equatorial Guinea', 'Eritrea', 'Ethiopia', 'Gambia', 'Guinea', 'India', 'Iran (Islamic Republic of)', 'Iraq', 'Jamaica', 'Jordan', 'Kuwait', 'Lao People's Democratic Republic', 'Lebanon', 'Libya', 'Malaysia', 'Mauritania', 'Monaco', 'Mongolia', 'Montenegro', 'Morocco', 'Mozambique', 'Myanmar', 'Namibia', 'Oman', 'Qatar', 'Rwanda', 'San Marino', 'Saudi Arabia', 'Somalia', 'South Africa', 'Sri Lanka', 'Syrian Arab Republic', 'Tajikistan', 'Thailand', 'The former Yugoslav Republic of Macedonia', 'Timor-Leste', 'Togo', 'Tonga', 'Uganda', 'Ukraine', 'United Arab Emirates', 'Uzbekistan', 'Yemen', 'Zimbabwe']

Cluster 2 Center: {'Action taken on climate change': 0.048581635756306155, 'Better transport and roads': 0.051661317577753843, 'Equality between men and women': 0.084273348073192325, 'Reliable energy at home': 0.064472042130835405, 'Access to clean water and sanitation': 0.090653397089613841, 'A responsive government we can trust': 0.04467515416960921, 'Support for people who can't work': 0.069028136320015365, 'Protecting forests rivers and oceans': 0.072736082339561539, 'Phone and internet access': 0.038160886905375391, 'Freedom from discrimination and persecution': 0.052202579163264595, 'Protection against crime and violence':

0.048312205861466159, 'A good education': 0.082386245900104627, 'Better healthcare': 0.11043796842752157, 'Country': 0.0391060539081, 'Political freedoms': 0.054720431459901513, 'Affordable and nutritious food': 0.04859251491738923}

Cluster 3 Countries: ['Australia', 'Austria', 'Belgium', 'Canada', 'Denmark', 'Finland', 'France', 'Germany', 'Iceland', 'Ireland', 'Italy', 'Liechtenstein', 'Luxembourg', 'Malta', 'Netherlands', 'New Zealand', 'Norway', 'Palau', 'Sweden', 'Switzerland', 'United Kingdom of Great Britain and Northern Ireland', 'United States of America', 'Uruguay']

Cluster 3 Center: {'Action taken on climate change': 0.01824036872121609, 'Better transport and roads': 0.02788598554827652, 'Equality between men and women': 0.046846232875978264, 'Reliable energy at home': 0.081830643380717397, 'Access to clean water and sanitation': 0.068516218472095658, 'A responsive government we can trust': 0.024550520977078261, "Support for people who can't work": 0.092747030840943503, 'Protecting forests rivers and oceans': 0.068930720278356547, 'Phone and internet access': 0.027405007394308695, 'Freedom from discrimination and persecution': 0.068517654026485214, 'Protection against crime and violence': 0.053458455764817392, 'A good education': 0.085308116149739127, 'Better healthcare': 0.10956223104804783, 'Country': 0.071871420194056526, 'Political freedoms': 0.074177293117108703, 'Affordable and nutritious food': 0.080152101210847843}

Cluster 4 Countries: ['Albania', 'Algeria', 'Bhutan', 'Bosnia and Herzegovina', 'Cape Verde', 'Congo', 'Cote d'Ivoire', 'Dominican Republic', 'Egypt', 'Fiji', 'Gabon', 'Georgia', 'Ghana', 'Grenada', 'Haiti', 'Indonesia', 'Kiribati', 'Kyrgyzstan', 'Lesotho', 'Liberia', 'Malawi', 'Maldives', 'Mali', 'Mexico', 'Nauru', 'Nepal', 'Nicaragua', 'Nigeria', 'Pakistan', 'Paraguay', 'Philippines', 'Serbia', 'Sierra Leone', 'Sudan', 'Swaziland', 'Tunisia', 'Tuvalu', 'United Republic of Tanzania', 'Zambia', 'Palestine (State of)']

Cluster 4 Center: {'Action taken on climate change': 0.052410545917185004, 'Better transport and roads': 0.056885200039727503, 'Equality between men and women': 0.11427302028717498, 'Reliable energy at home': 0.066427800621807476, 'Access to clean water and sanitation': 0.11086002499897001, 'A responsive government we can trust': 0.038534547290152509, "Support for people who can't work": 0.061867179290004994, 'Protecting forests rivers and oceans': 0.072057291149029978, 'Phone and internet access': 0.031230111562801761, 'Freedom from discrimination and persecution': 0.044957817844530006, 'Protection against crime and violence': 0.03330443072465001, 'A good education': 0.075804915966402514, 'Better healthcare': 0.12847090936565003, 'Country': 0.028615581412225498, 'Political freedoms': 0.046289858471572499, 'Affordable and nutritious food': 0.038010765058070009}

All Countries Average: {'Action taken on climate change': 0.040362318824958117, 'Better transport and roads': 0.044922725048209017, 'Equality between men and women': 0.083567351268570622, 'Reliable energy at home': 0.069640624932437611, 'Access to clean water and sanitation': 0.093688638061418, 'A responsive government we can trust': 0.035228129227895873, "Support for people who can't work": 0.071793531572995867, 'Protecting forests rivers and oceans': 0.07668642077818609, 'Phone and internet access': 0.031976156171139011, 'Freedom from

discrimination and persecution': 0.051917129214374545, 'Protection against crime and violence': 0.041296169492136062, 'A good education': 0.084643447889391765, 'Better healthcare': 0.11663709974964076, 'Country': 0.044295448447228963, 'Political freedoms': 0.056111443861254627, 'Affordable and nutritious food': 0.057233365460164463}

Looking at these results we can see that the cluster sizes are all different. Cluster 1 is the largest, followed by cluster 2, then cluster 4, then cluster 3. The latter two clusters are significantly smaller than the first two clusters.

The countries in the clusters appear to be related by both region and level of development. For example, most countries in cluster 3 are highly-industrialized, Western countries. By contrast, many countries in cluster 2 are developing and politically unstable. Cluster 1 countries are somewhere between 3 and 2 in terms of development and political stability. Many countries in cluster 4 are small, less developed nations.

In cluster 1, we can see that compared to the average of all countries, they prioritize above a good education and having a clean environment more than all countries on average. By contrast, they prioritize action taken on climate change as well as transportation and roads less than all countries on average. In cluster 2, we can see that these countries prioritize a responsive and trustworthy government and protection against crime and violence more than all countries on average. These countries prioritize a good education and support for people who can't work less than all countries on average. Countries in cluster 3 prioritize support for people who can't work and freedom discrimination and persecution more than all countries on average. Contrastly, countries in this cluster prioritize action taken on climate change and equality between men and women less than all countries on average; perhaps this is because these countries have more climate change and gender equity-related efforts than all countries on average. Cluster 4 is above average on action taken on climate change, wanting better infrastructure and health care. However, they are below average on supporting people who can't work, a good education, as well as political freedoms and affordable and nutritious food.

We picked to look at the United Kingdom. This country belongs to cluster 3. These countries are high on political freedoms, availability of affordable and nutritious food as well as many other qualities that we associate with more developed countries. The countries generally seem like wealthy and developed European and North American. One country I was surprised to see in this cluster was Uruguay as this is in South America and is not usually talked about as one of the more developed countries whereas most of the other countries in this cluster are.