Question 1.

Q1(a).

Scrapping The data from [BBC Good Food. (https://www.bbcgoodfood.com)](https://www.bbcgoodfood.com)

```python
In [78]: from bs4 import BeautifulSoup
         import urllib
         import re
         import urllib.request as urllib2
         import pandas as pd
```

```python
In [79]: def printRecipe(url,recipe_id):
             list_ingredients=[]
             page = urllib2.urlopen(url)
             soup = BeautifulSoup(page)
             soup_rs=soup.find_all('li', class_="pb-xxs pt-xxs list-item list-item--separator")
             list_ingredients=[]
             print("INGREDIENTS SECTION\n\n")
             for x in soup_rs:
                 print('\t',re.compile(r'<[^>]+>').sub('', str(x)))
             soup_rs=soup.find_all('div', class_="editor-content")
             i=0
             print("\n\nCOOKING INSTRUCTIONS\n\n")
             for x in soup_rs:
                 st=str(x)
                 i+=1
                 if(len(re.compile(r'<[^>]+>').sub('', st))>0):
                     print(i,'.',re.compile(r'<[^>]+>').sub('', st))
             soup_ingredients=soup.find_all('a', class_="link link--styled")
             for x in soup_ingredients:
                 list_ingredients.append(tuple([recipe_id,re.compile(r'<[^>]+>').sub('', str(x))]))
             return list_ingredients
```

In [80]:
```python
list_URLs=['bombay-potato-frittata','spiced-lentil-butternut-squash-soup','roasted-red-pepper-tomato-soup
-ricotta','power-packed-pasta-boxes','chickpea-tagine-soup','spicy-tuna-cottage-cheese-jacket','green-clu
b-sandwich']
list_ingredients=[]
for url in list_URLs:
    print('\n_____'+url+'_____')
    list_ingredients+=printRecipe('https://www.bbcgoodfood.com/recipes/'+url,url)
```

_____bombay-potato-frittata_____

INGREDIENTS SECTION

        4 new potatoes , sliced into 5mm rounds
        100g baby spinach , chopped
        1 tbsp rapeseed oil
        1 onion , halved and sliced
        1 large garlic clove , finely grated
        ½ tsp ground coriander
        ½ tsp ground cumin
        ¼ tsp black mustard seeds
        ¼ tsp turmeric
        3 tomatoes , roughly chopped
        2 large eggs
        ½ green chilli , deseeded and finely chopped
        1 small bunch of coriander , finely chopped
        1 tbsp mango chutney
        3 tbsp fat-free Greek yogurt

COOKING INSTRUCTIONS

1 . Pack in the flavour with this Indian-inspired frittata. Perfect for a healthy lunch, it's low in calories and fat and full of nutrients
2 . Cook the potatoes in a pan of boiling water for 6 mins, or until tender. Drain and leave to steam-dry. Meanwhile, put the spinach in a heatproof bowl with 1 tbsp water. Cover and microwave for 3 mins on high, or until wilted.
3 . Heat the rapeseed oil in a medium non-stick frying pan. Add the onion and cook over a medium heat for 10 mins until golden and sticky. Stir in the garlic, ground coriander, ground cumin, mustard seeds and turmeric, and cook for 1 min more. Add the tomatoes and wilted spinach and cook for another 3 mins, then add the potatoes.
4 . Heat the grill to medium. Lightly beat the eggs with the chilli and most of the fresh coriander and pour over the potato mixture. Grill for 4-5 mins, or until golden and just set, with a very slight wobble in the middle.
5 . Leave to cool, then slice into wedges. Mix the mango chutney, yogurt and remaining fresh coriander together. Serve with the frittata wedges.

_____spiced-lentil-butternut-squash-soup_____
_____

INGREDIENTS SECTION

2 tbsp olive oil
2 onions, finely chopped
2 garlic cloves, crushed
¼ tsp hot chilli powder
1 tbsp ras el hanout
1 butternut squash, peeled and cut into 2cm pieces
100g red lentils
1l hot vegetable stock
1 small bunch coriander, leaves chopped, plus extra to serve
dukkah (see tip) and natural yogurt, to serve

COOKING INSTRUCTIONS

1 . Cook a big batch of this filling spiced lentil and squash soup and freeze the leftovers for a speedy s
upper another day. It's healthy and low in fat
2 . Heat the oil in a large flameproof casserole dish or saucepan over a medium-high heat. Fry the onions
with a pinch of salt for 7 mins, or until softened and just caramelised. Add the garlic, chilli and ras el
hanout, and cook for 1 min more.
3 . Stir in the squash and lentils. Pour over the stock and season to taste. Bring to the boil, then reduc
e the heat to a simmer and cook, covered, for 25 mins or until the squash is soft. Blitz the soup with a s
tick blender until smooth, then season to taste. To freeze, leave to cool completely and transfer to large
freezerproof bags.
4 . Stir in the coriander leaves and ladle the soup into bowls. Serve topped with the dukkah, yogurt and e
xtra coriander leaves.

_____roasted-red-pepper-tomato-soup-ricotta_____
_____

INGREDIENTS SECTION

400g tomatoes , halved
1 red onion , quartered
2 Romano peppers , roughly chopped
2 tbsp good quality olive oil
2 garlic cloves , bashed in their skins
few thyme sprigs
1 tbsp red wine vinegar

```
                    2 tbsp ricotta
                    few basil leaves
                    1 tbsp mixed seeds , toasted
                    bread , to serve
```

COOKING INSTRUCTIONS

1 . Liven up a tomato soup with a few easy and tasty additions, including a spoonful of ricotta. It's clas
sic comfort food and also a low-calorie, healthy option
2 . Heat oven to 200C/180C fan/gas 6. Put the tomatoes, onion and peppers in a roasting tin, toss with the
oil and season. Nestle in the garlic and thyme sprigs, then roast for 25-30 mins until all the veg has sof
tened and slightly caramelised. Squeeze the garlic cloves out of their skins into the tin, strip the leave
s off the thyme and discard the stalks and garlic skins. Mix the vinegar into the tin then blend everythin
g in a bullet blender or using a stick blender, adding enough water to loosen to your preferred consistenc
y (we used around 150ml).
3 . Reheat the soup if necessary, taste for seasoning, then spoon into two bowls and top each with a spoon
ful of ricotta, a few basil leaves, the seeds and a drizzle of oil. Serve with bread for dunking.

_____power-packed-pasta-boxes_____
INGREDIENTS SECTION

                    2 red onions , halved and thinly sliced
                    150g wholemeal penne
                    1 lemon , zested and juiced
                    1 tbsp rapeseed oil , plus a little extra for drizzling
                    2 large garlic cloves , finely grated
                    30g pack basil , chopped, stems and all
                    ½ red pepper , sliced
                    1 salmon fillet
                    1 tsp capers
                    big handful rocket
                    1 large courgette , sliced
                    1 skinless chicken breast fillet, thickly sliced (150g)
                    2 tsp pesto
                    5 large cherry tomatoes , halved (80g)
                    1 small aubergine , sliced then diced (about 275g)
                    5 large cherry tomatoes , quartered (80g)
                    5 kalamata olives , halved
```

COOKING INSTRUCTIONS

1 . Make three lunchbox pasta meals in one go to save you time midweek. They're nutritious and healthy with variations using salmon, chicken and aubergine

2 . Heat oven to 200C/180C fan/gas 6. Arrange the red onions, red pepper, courgette and aubergine in lines on a large baking sheet. Drizzle with a little oil and roast for 15 mins.

3 . Cook the pasta for 10-12 mins until al dente. While the pasta is cooking, loosely wrap the salmon fillet in foil and do the same with the chicken and pesto in another foil parcel, then put them on another baking tray.

4 . When the veg have had their 15 mins, put the salmon and chicken in the oven and cook for a further 12 mins (or until the chicken is cooked through). Drain the pasta, put in a bowl and toss really well with the lemon zest and juice, rapeseed oil, garlic and two-thirds of the basil. When everything is cooked, add the red onions to the pasta. Toss together and divide between three lunch boxes.

5 . Top the first box with the salmon fillet (remove the skin first), then add the red pepper from the tray. Scatter over the capers and add the rocket. To the second box, add the chicken and pesto with any juices, the roasted courgette and the halved cherry tomatoes. In the third box, toss the aubergine into the pasta with the quartered cherry tomatoes, olives and the remaining basil. Seal up each container and chill. Eat within three days, preferably in the order of the salmon, then the chicken and then the aubergine.

6 . RECIPE TIPSNUTRITIONAL INFORMATIONSalmon pasta: 579 kcals, fat 25g, saturates 4g, carbs 43g, sugars 10g, fibre 9g, protein 41g, salt 0.5gNUTRITIONAL INFORMATIONChicken pasta: 475 kcals, fat 10g, saturates 1g, carbs 45g, sugars 0g, fibre 9g, protein 47g, salt 0.4gNUTRITIONAL INFORMATIONAubergine pasta: 367 kcals, fat 11g, saturates 1g, carbs 48g, sugars 15g, fibre 15g, protein 11g, salt 0.8g

7 . NUTRITIONAL INFORMATIONSalmon pasta: 579 kcals, fat 25g, saturates 4g, carbs 43g, sugars 10g, fibre 9g, protein 41g, salt 0.5g

8 . NUTRITIONAL INFORMATIONChicken pasta: 475 kcals, fat 10g, saturates 1g, carbs 45g, sugars 0g, fibre 9g, protein 47g, salt 0.4g

9 . NUTRITIONAL INFORMATIONAubergine pasta: 367 kcals, fat 11g, saturates 1g, carbs 48g, sugars 15g, fibre 15g, protein 11g, salt 0.8g

_____chickpea-tagine-soup_____

INGREDIENTS SECTION

        2 red peppers
        1 tbsp rapeseed oil
        1 red onion , thinly sliced
        2 large garlic cloves , crushed
        2 tsp ground coriander
        1 tsp ground cumin
        2 tbsp rose harissa paste

```
2 x 400g cans chickpeas , drained and rinsed
1 ½l low-salt veg stock
150g kale , chopped
1 lemon , zested and juiced
50g dried apricots , finely chopped
1⁄2 small bunch parsley , finely chopped
fat-free natural yogurt , to serve (optional)
```

COOKING INSTRUCTIONS

1 . Discover the rustic flavours of tagine in a soup. Packed with chickpeas, peppers and kale plus apricots for sweetness, this satisfying soup is super-healthy
2 . Heat the grill to its highest setting. Halve and deseed the peppers, then lay cut-side down on a baking sheet lined with foil. Grill for 10-15 mins, or until blistered and softened. Leave until cool enough to handle, then remove and discard the skins. Slice the roasted peppers into thin strips.
3 . Heat the oil in a large saucepan over a low heat. Fry the onion for 8-10 mins until softened. Stir through the garlic, coriander, cumin and harissa paste and cook for 1 min more. Add the chickpeas and stock, bring to the boil and simmer for 15 mins, covered.
4 . Stir the peppers through the soup with the kale, lemon zest and juice, and apricots and cook, covered, for another 5 mins. Ladle the soup into bowls and serve with the chopped parsley scattered over and a dollop of yogurt, if you like.

_____spicy-tuna-cottage-cheese-jacket_____

INGREDIENTS SECTION

```
225g can tuna , drained
½  red chilli , chopped
1 spring onion , sliced
handful halved cherry tomatoes
½ small bunch  coriander , chopped
1 medium-sized jacket potato
150g low-fat cottage cheese
```

COOKING INSTRUCTIONS

1 . For a low-fat energy lunch try a carbohydrate-heavy baked potato with a light and nutritious filling

2 . Preheat the oven to 180C/Gas 4/fan oven 160C. Prick the potato several times with a fork and put it st
raight onto a shelf in the hottest part of the oven. Bake for approximately 1 hour, or until it is soft in
side.
3 . Mix tuna with chilli, spring onion, cherry tomatoes and coriander. Split jacket potato and fill with t
he tuna mix and cottage cheese.

_____green-club-sandwich_____
INGREDIENTS SECTION

        3 slices wholegrain or rye toast
        3 tbsp ready-made hummus
        1 small avocado (100g), stoned and sliced
        1 handful rocket leaves
        8-12 cherry tomatoes , sliced

COOKING INSTRUCTIONS

1 . This healthy sandwich is packed full of goodness to keep you going until dinner
2 . Toast the bread and spread hummus evenly over one side of each slice. On one slice of bread, lay half
the avocado, rocket and tomato. Season with pepper, then cover with another slice.
3 . Pile on the rest of the avocado, rocket and tomato, season again and top with the third slice.

Q1(b).

Storing the Recipe:

1. First I stored the Recipe ID-Ingredient pair into Pandas DataFrame
2. Now I stored data Dataframe to RecepieID_Ingredient.csv csv file


```
In [81]:  df = pd.DataFrame(list_ingredients, columns = ['Recipe ID', 'Ingredient'])
          df.to_csv('RecepieID_Ingredient.csv',index=False)
```


Q1(c).

Aspects of the recipes are being lost in the process of coarse-graining the recipe data:

1. Data about cooking Steps is Lost.
2. Step Sequence has lost.
3. Ingredient Quantity has lost.
4. The form in which we are using ingredients is lost
5. Cooking time and step performing time has lost

Q1(d).

To extract the most details from the recipe we can use other storing data structure where everything can be stored.

for example: Dataframe with more columns where we can store the quantity of the used ingredient and the form in which we are using them and other details and store it in a csv file.

Question 2.

Q2(a).

```
In [82]: import json
         import pandas as pd
         import os
         import matplotlib.pyplot as plt
         import seaborn as sns
         import numpy as np
         from operator import itemgetter
         from itertools import chain
```

In [83]:
```python
path='/home/gaurav/Desktop/IIIT Delhi/Courses/CGAS/Assignments/Assignment1/683_1293_bundle_archive/train.json'
df=pd.read_json(path)
data = pd.read_json(path)
```

In [84]:
```python
list_All_ingredients=[]
list_no_of_ingredients=[]
for x in data['ingredients']:
    list_All_ingredients+=x
    list_no_of_ingredients.append(len(x))
list_ingredients=list(set(list_All_ingredients))
print("No of Recipes: ",len(data))
print("No of unique ingredients: ",len(list_ingredients))
print("No of cuisines: ",len(set(data['cuisine'])))
```

```
No of Recipes:  39774
No of unique ingredients:  6714
No of cuisines:  20
```

Q2(b).

Statistics (bar plot) of number of recipes for each cuisine:

In [85]:
```python
sns.countplot(data['cuisine'])
plt.xticks(rotation = 80,fontsize = 10)
```

```
Out[85]: (array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
                  17, 18, 19]),
          [Text(0, 0, 'greek'),
           Text(1, 0, 'southern_us'),
           Text(2, 0, 'filipino'),
           Text(3, 0, 'indian'),
           Text(4, 0, 'jamaican'),
           Text(5, 0, 'spanish'),
           Text(6, 0, 'italian'),
           Text(7, 0, 'mexican'),
           Text(8, 0, 'chinese'),
           Text(9, 0, 'british'),
           Text(10, 0, 'thai'),
           Text(11, 0, 'vietnamese'),
           Text(12, 0, 'cajun_creole'),
           Text(13, 0, 'brazilian'),
           Text(14, 0, 'french'),
           Text(15, 0, 'japanese'),
           Text(16, 0, 'irish'),
           Text(17, 0, 'korean'),
           Text(18, 0, 'moroccan'),
           Text(19, 0, 'russian')])
```
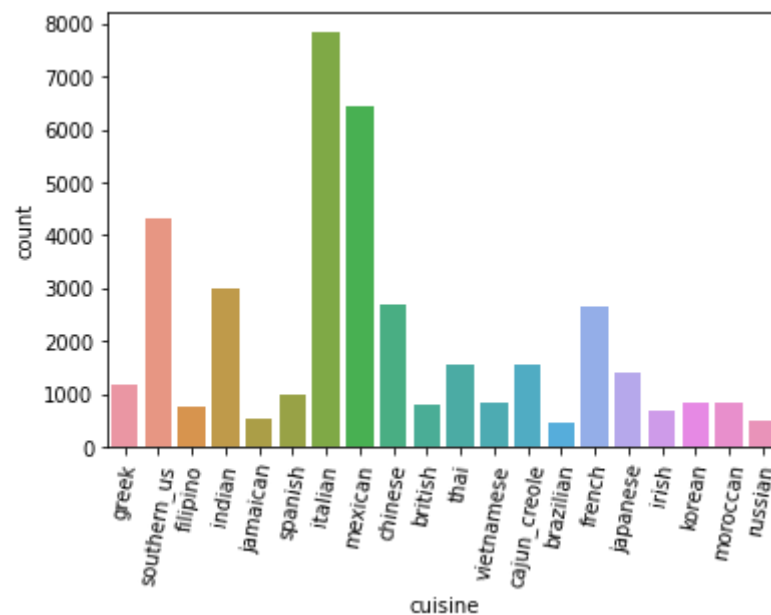
Q2(c).

Recipe size distribution plot for all the recipes:

```
In [86]: def makecountPlot(list_num,l):
             list_distinct=list(set(list_num))
             list_distinct.sort()
             list_percentage_of_recipes=[]
             for x in list_distinct:
                 list_percentage_of_recipes.append(list_num.count(x)*100/l)
             return list_distinct, list_percentage_of_recipes
```

```python
In [87]: x_val,y_val=makecountPlot(list_no_of_ingredients,len(list_no_of_ingredients))
         plt.figure(figsize=(13, 6))
         plt.plot(x_val,y_val,'.-')
         plt.xlabel('Recipe Size')
         plt.ylabel('Percentage')
         plt.title('Recipe size distribution plot')
         plt.show()
```
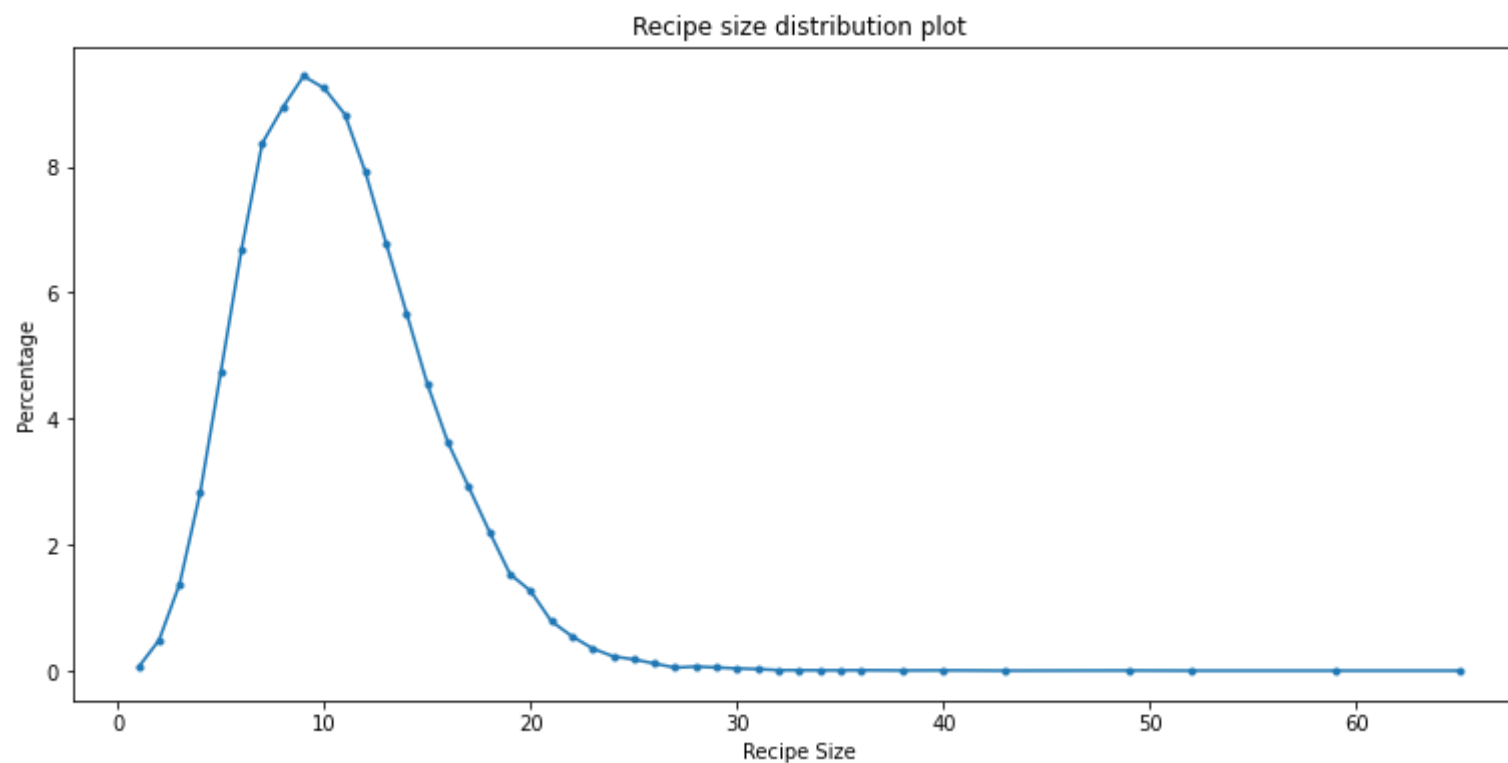

Recipe size distribution plot for each cuisine:

In [88]:
```python
dict_all_cuisine_size={}
dict_cusine_ingredients={}
for i in range( len(data['cuisine'])):
    if data['cuisine'].loc[i] not in dict_all_cuisine_size:
        dict_all_cuisine_size[data['cuisine'].loc[i]]=[]
    dict_all_cuisine_size[data['cuisine'].loc[i]].append(len(data['ingredients'].loc[i]))
    if data['cuisine'].loc[i] not in dict_cusine_ingredients:
        dict_cusine_ingredients[data['cuisine'].loc[i]]=[]
    dict_cusine_ingredients[data['cuisine'].loc[i]]+=(list(data['ingredients'].loc[i]))
plt.figure(figsize=(13, 6))
for x in dict_all_cuisine_size:
    x_val,y_val=makecountPlot(dict_all_cuisine_size[x],len(dict_all_cuisine_size[x]))
    plt.plot(x_val, y_val,  '.-',label=x)
    plt.legend(loc="upper right",prop={'size': 10})
plt.xlabel('Recipe Size')
plt.ylabel('Percentage')
plt.title('All Recipes size distribution plot')
plt.show()
```

All Recipes size distribution plot
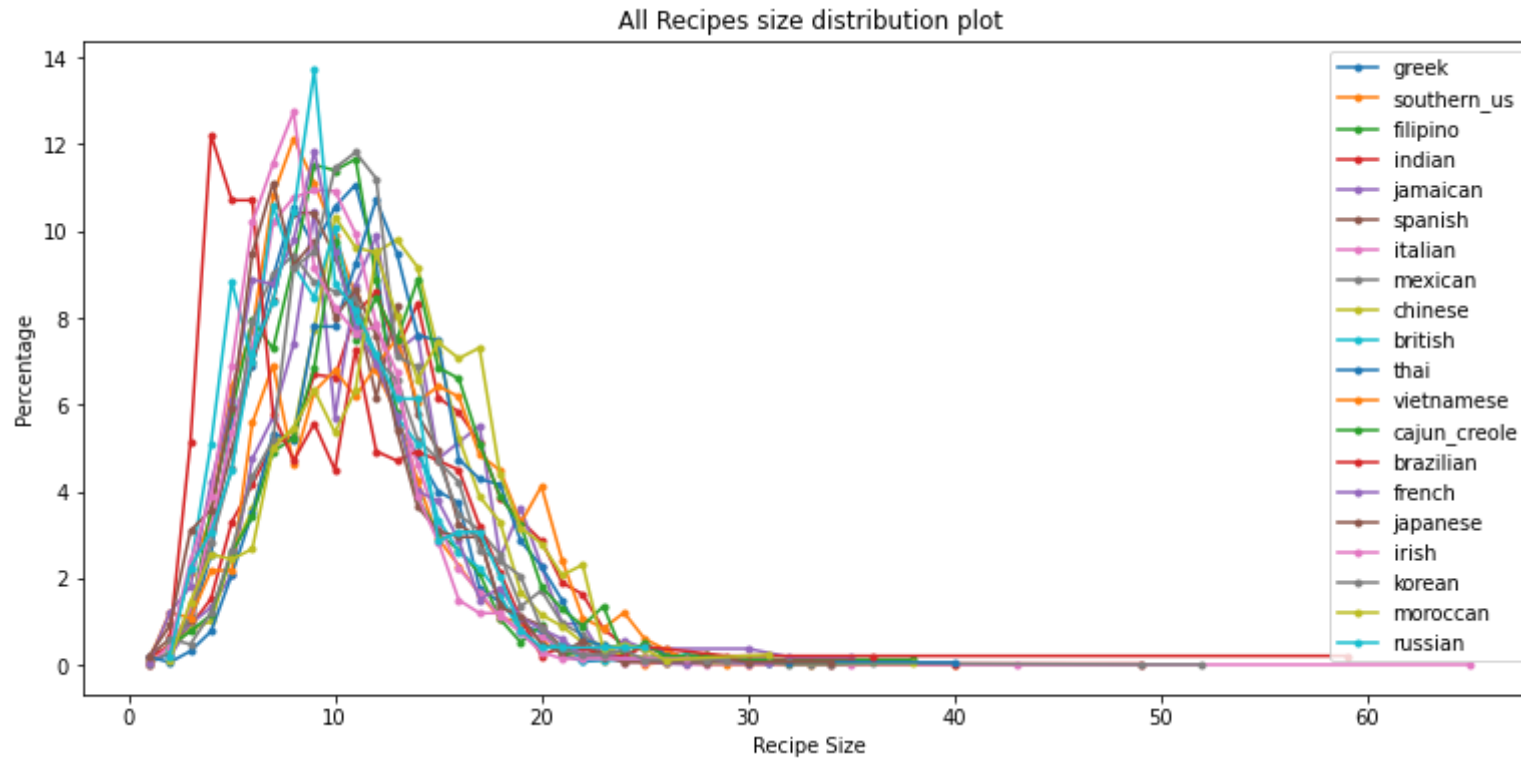
Q2(d).

Cumulative distribution plot of All recipe size.

```
In [89]: def plot_recipe_cum_distribution(list_no_of_ingredients):
             list_no_of_ingredients.sort()
             dist_list_no_of_ingredients=set(list_no_of_ingredients)
             l=len(list_no_of_ingredients)
             list_fraction_of_recipe=[]
             for x in dist_list_no_of_ingredients:
                 index=list_no_of_ingredients.index(x)
                 fraction=(l-index)/l
                 list_fraction_of_recipe.append(fraction)
             return  list(dist_list_no_of_ingredients),list_fraction_of_recipe
```

In [90]:
```python
x_val,y_val=plot_recipe_cum_distribution(list_no_of_ingredients)
plt.figure(figsize=(13, 6))
plt.plot(x_val, y_val, '.-',label=x)
plt.xlabel('Recipe Size')
plt.ylabel('Cumulative Percentage')
plt.title('Cumulative distribution of all recipe size plot')
plt.show()
```


Cumulative distribution of all recipe size plot
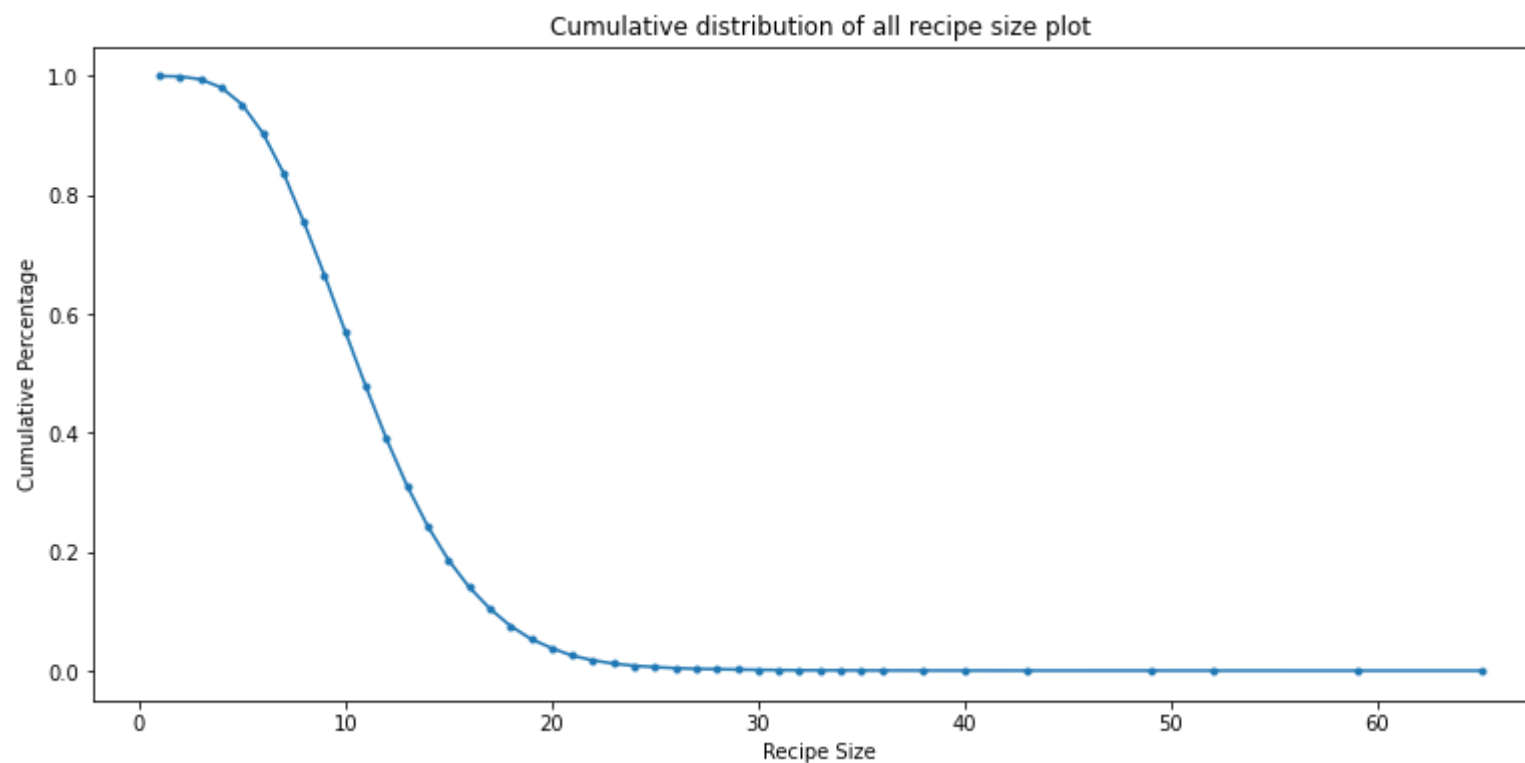
Cumulative distribution plot of cuisines recipe size.

In [91]:
```python
plt.figure(figsize=(13, 6))
for x in dict_all_cuisine_size:
    x_val,y_val=plot_recipe_cum_distribution(dict_all_cuisine_size[x])
    plt.plot(x_val, y_val,'.-', label=x)
    plt.legend(loc="upper right",prop={'size': 6})
plt.xlabel('Recipe Size')
plt.ylabel('Cumulative Percentage')
plt.title('Cumulative distribution of recipe size plot')
plt.show()
```


Cumulative distribution of recipe size plot
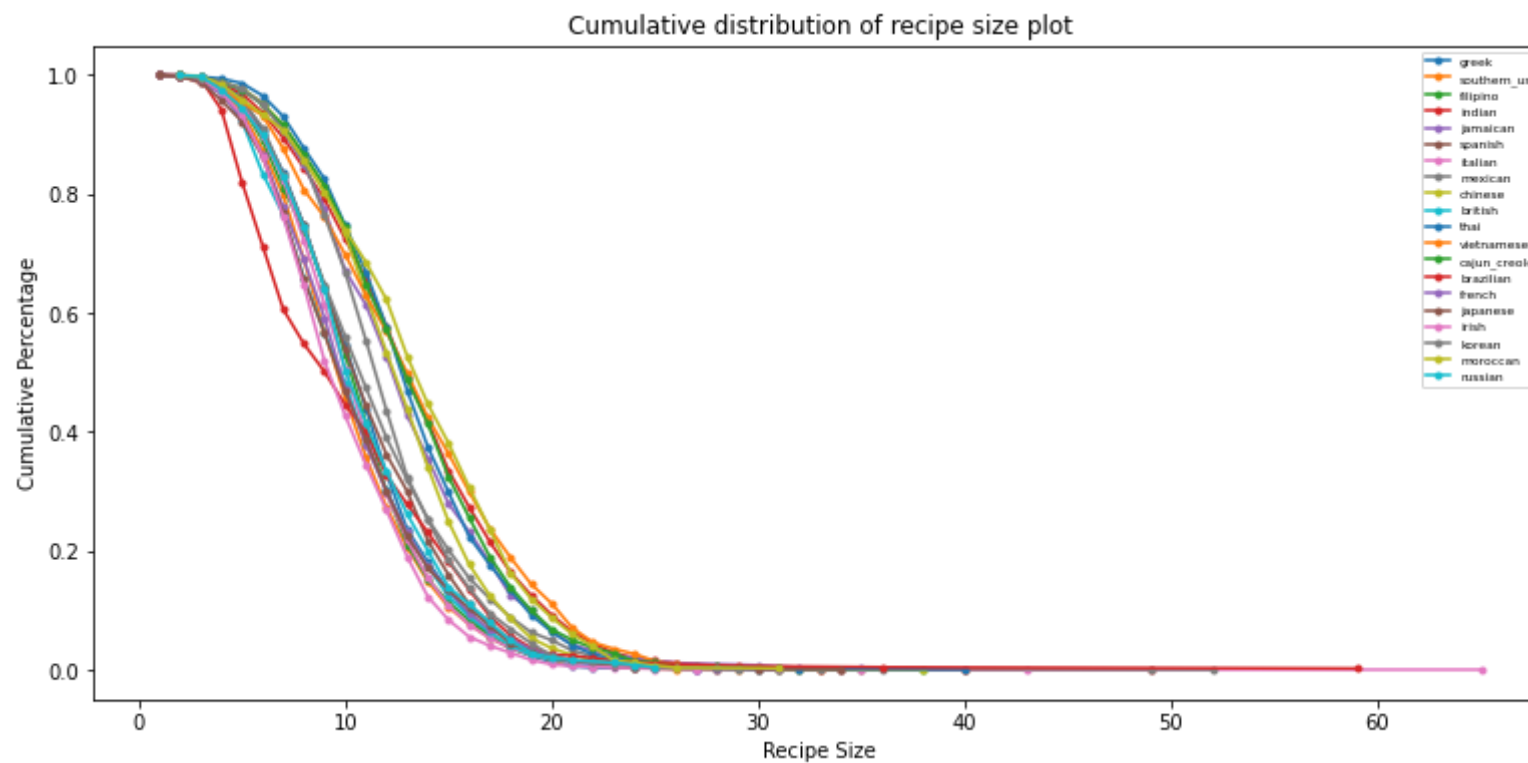
Interpretations

1. All the recipe uses more than 1 ingredient.
2. Most of the cuisines prepared by using less than 20 ingredients
3. There are very less cousines who uses more than 25 ingredients.

Question 3

Q3(a).

In [92]:
```python
def plot_frequency_rank_distribution(list_All_ingredients,lab):
    dict_ingredient_count={}
    for x in list_All_ingredients:
        if x not in dict_ingredient_count:
            dict_ingredient_count[x]=1
        else:
            dict_ingredient_count[x]+=1
    dict_ingredient_count=sorted(dict_ingredient_count.items(), key = lambda kv:(kv[1], kv[0]),reverse=True)
    ingredient_count_list=[]
    i=1
    rank=[]
    for x in dict_ingredient_count:
        rank.append(i)
        i+=1
        ingredient_count_list.append(x[1])
    ingredient_count_list = np.array(ingredient_count_list)
#     print(ingredient_count_list)
    ingredient_count_list=ingredient_count_list/ingredient_count_list[0]
    plt.xlim(1e-1, 1e4)
    plt.ylim(1e-5, 1e1)
    plt.loglog(rank,ingredient_count_list,'.-',label=lab)

    plt.xlabel('Rank')
    plt.ylabel('Frequency')
    plt.legend(loc="upper right",prop={'size': 8})
```

```
In [93]: plt.figure(figsize=(13, 6))
         plot_frequency_rank_distribution(list_All_ingredients,'All Recepies')
         plt.title('Frequency-rank distribution for all the recipes')
```

Out[93]: Text(0.5, 1.0, 'Frequency-rank distribution for all the recipes')
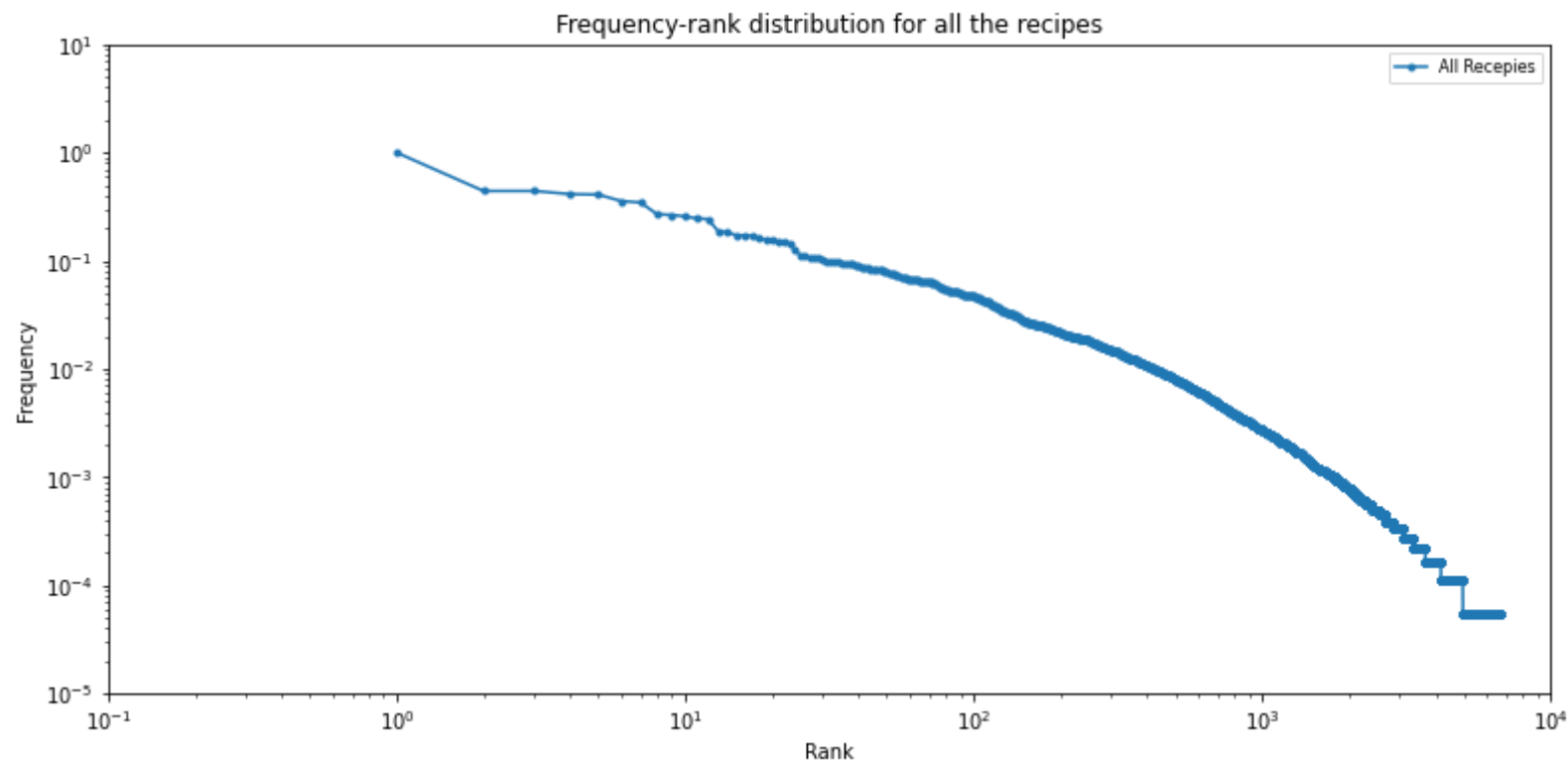
Interpretations

1. World Recipe's ingredient rank plot follows power low
2. Some ingredients are used in most of the recipe they have high rank for ex. salt.

Q3(b).

Top 10 most popular ingredients in the recipes.

```
In [94]: def find_important_ingredients(list_cusine_ingredients):
             dict_ingredient={}
             for x in list_cusine_ingredients:
                 if x not in dict_ingredient:
                     dict_ingredient[x]=0
                 dict_ingredient[x]+=1
             dict_ingredient=sorted(dict_ingredient.items(), key = lambda kv:(kv[1], kv[0]),reverse=True)
             list_imp_ingredients=[]
             for x in dict_ingredient[:10]:
                 list_imp_ingredients.append(x[0])
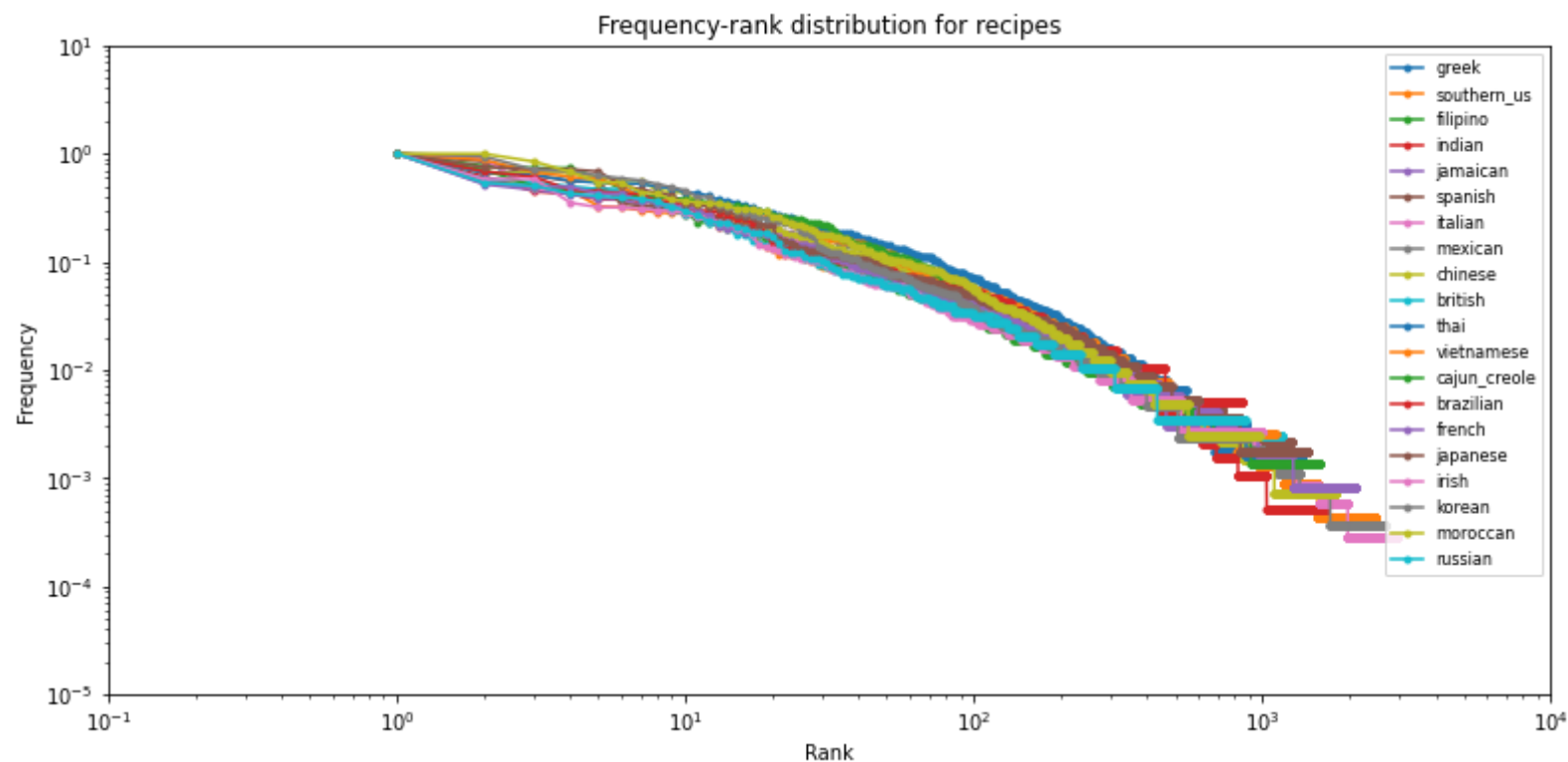             return list_imp_ingredients
```

```
In [95]: print("Top 10 important ingredients: ", find_important_ingredients(list_All_ingredients))

         Top 10 important ingredients:  ['salt', 'onions', 'olive oil', 'water', 'garlic', 'sugar', 'garlic clove
         s', 'butter', 'ground black pepper', 'all-purpose flour']
```

Q3(c).

In [96]:
```python
i=0
plt.figure(figsize=(13, 6))
for x in dict_cusine_ingredients:
    plot_frequency_rank_distribution(dict_cusine_ingredients[x],x)
plt.title('Frequency-rank distribution for recipes')
```

Out[96]: Text(0.5, 1.0, 'Frequency-rank distribution for recipes')

```
In [97]: for x in dict_cusine_ingredients:
             print("List of top 10 important ingredients in recepe",x,":\n",find_important_ingredients(dict_cusine
         _ingredients[x]),'\n')
```

List of top 10 important ingredients in recepe greek :
['salt', 'olive oil', 'dried oregano', 'garlic cloves', 'feta cheese crumbles', 'extra-virgin olive oil', 'fresh lemon juice', 'ground black pepper', 'garlic', 'pepper']

List of top 10 important ingredients in recepe southern_us :
['salt', 'butter', 'all-purpose flour', 'sugar', 'large eggs', 'baking powder', 'water', 'unsalted butter', 'milk', 'buttermilk']

List of top 10 important ingredients in recepe filipino :
['salt', 'garlic', 'water', 'onions', 'soy sauce', 'pepper', 'oil', 'sugar', 'carrots', 'ground black pepper']

List of top 10 important ingredients in recepe indian :
['salt', 'onions', 'garam masala', 'water', 'ground turmeric', 'garlic', 'cumin seed', 'ground cumin', 'vegetable oil', 'oil']

List of top 10 important ingredients in recepe jamaican :
['salt', 'onions', 'water', 'garlic', 'ground allspice', 'pepper', 'scallions', 'dried thyme', 'black pepper', 'garlic cloves']

List of top 10 important ingredients in recepe spanish :
['salt', 'olive oil', 'garlic cloves', 'extra-virgin olive oil', 'onions', 'water', 'tomatoes', 'ground black pepper', 'red bell pepper', 'pepper']

List of top 10 important ingredients in recepe italian :
['salt', 'olive oil', 'garlic cloves', 'grated parmesan cheese', 'garlic', 'ground black pepper', 'extra-virgin olive oil', 'onions', 'water', 'butter']

List of top 10 important ingredients in recepe mexican :
['salt', 'onions', 'ground cumin', 'garlic', 'olive oil', 'chili powder', 'jalapeno chilies', 'sour cream', 'avocado', 'corn tortillas']

List of top 10 important ingredients in recepe chinese :
['soy sauce', 'sesame oil', 'salt', 'corn starch', 'sugar', 'garlic', 'water', 'green onions', 'vegetable oil', 'scallions']

List of top 10 important ingredients in recepe british :
['salt', 'all-purpose flour', 'butter', 'milk', 'unsalted butter', 'eggs', 'sugar', 'onions', 'baking powder', 'large eggs']

List of top 10 important ingredients in recepe thai :

['fish sauce', 'garlic', 'salt', 'coconut milk', 'vegetable oil', 'soy sauce', 'sugar', 'water', 'garlic cloves', 'fresh lime juice']

List of top 10 important ingredients in recepe vietnamese :
['fish sauce', 'sugar', 'salt', 'garlic', 'water', 'carrots', 'soy sauce', 'shallots', 'garlic cloves', 'vegetable oil']

List of top 10 important ingredients in recepe cajun_creole :
['salt', 'onions', 'garlic', 'green bell pepper', 'butter', 'olive oil', 'cayenne pepper', 'cajun seasoning', 'all-purpose flour', 'water']

List of top 10 important ingredients in recepe brazilian :
['salt', 'onions', 'olive oil', 'lime', 'water', 'garlic cloves', 'garlic', 'cachaca', 'sugar', 'tomatoes']

List of top 10 important ingredients in recepe french :
['salt', 'sugar', 'all-purpose flour', 'unsalted butter', 'olive oil', 'butter', 'water', 'large eggs', 'garlic cloves', 'ground black pepper']

List of top 10 important ingredients in recepe japanese :
['soy sauce', 'salt', 'mirin', 'sugar', 'water', 'sake', 'rice vinegar', 'vegetable oil', 'scallions', 'ginger']

List of top 10 important ingredients in recepe irish :
['salt', 'butter', 'all-purpose flour', 'onions', 'sugar', 'potatoes', 'baking soda', 'baking powder', 'milk', 'carrots']

List of top 10 important ingredients in recepe korean :
['soy sauce', 'sesame oil', 'garlic', 'green onions', 'sugar', 'salt', 'water', 'sesame seeds', 'onions', 'scallions']

List of top 10 important ingredients in recepe moroccan :
['salt', 'olive oil', 'ground cumin', 'onions', 'ground cinnamon', 'garlic cloves', 'water', 'ground ginger', 'carrots', 'paprika']

List of top 10 important ingredients in recepe russian :
['salt', 'sugar', 'onions', 'all-purpose flour', 'sour cream', 'eggs', 'water', 'butter', 'unsalted butter', 'large eggs']

Q3(d).

Interpretations

1. World Recipe's ingredient rank plot follows power low.
2. Some ingredients are used in most of the recipe they have high rank for ex. salt.
3. Negative slope shows there are some ingredients they are used less frequently than some other ingredients.
4. Bottom end is falling faster because some ingredients has less frequency and they are used rarely in the cusines.