In [1]:
```
import pandas as pd
df=pd.read_csv(r'C:\Users\DELL\Desktop\Mall_Customers.csv')
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from mpl_toolkits.mplot3d import Axes3D
%matplotlib inline
df
```

Out[1]:

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40
...	...	...	...	...	...
195	196	Female	35	120	79
196	197	Female	45	126	28
197	198	Male	32	126	74
198	199	Male	32	137	18
199	200	Male	30	137	83

200 rows × 5 columns

In [2]:
```
df.head()
```

Out[2]:

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40

In [3]:
```
df.isnull().sum()
```

Out[3]:
```
CustomerID                0
Genre                     0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

In [4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype 
---  ------                  --------------  ----- 
 0   CustomerID              200 non-null    int64 
 1   Genre                   200 non-null    object
 2   Age                     200 non-null    int64 
 3   Annual Income (k$)      200 non-null    int64 
 4   Spending Score (1-100)  200 non-null    int64 
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

In [5]:
```
df.corr()
```

Out[5]:

	CustomerID	Age	Annual Income (k$)	Spending Score (1-100)
CustomerID	1.000000	-0.026763	0.977548	0.013835
Age	-0.026763	1.000000	-0.012398	-0.327227
Annual Income (k$)	0.977548	-0.012398	1.000000	0.009903
Spending Score (1-100)	0.013835	-0.327227	0.009903	1.000000

In [6]:
```
from sklearn.model_selection import train_test_split
x=df
y=df
x_train,x_test,y_train,y_test = train_test_split(x,y, test_size=0.25, random_state=42)
x_train
```

Out[6]:

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
114	115	Female	18	65	48
173	174	Male	36	87	92
5	6	Female	22	17	76
126	127	Male	43	71	35
117	118	Female	49	65	59
...	...	...	...	...	...
106	107	Female	66	63	50
14	15	Male	37	20	13
92	93	Male	48	60	49
179	180	Male	35	93	90
102	103	Male	67	62	59

150 rows × 5 columns

In [7]:
```
y_test
```

Out[7]:

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
95	96	Male	24	60	52
15	16	Male	22	20	79
30	31	Male	60	30	4
158	159	Male	34	78	1
128	129	Male	59	71	11
115	116	Female	19	65	50
69	70	Female	32	48	47
170	171	Male	40	87	13
174	175	Female	52	88	13
45	46	Female	24	39	65
66	67	Female	43	48	50
182	183	Male	46	98	15
165	166	Female	36	85	75
78	79	Female	23	54	52
186	187	Female	54	101	24
177	178	Male	27	88	69
56	57	Female	51	44	50
152	153	Female	44	78	20
82	83	Male	67	54	41
68	69	Male	19	48	59
124	125	Female	23	70	29
16	17	Female	35	21	35
148	149	Female	34	78	22
93	94	Female	40	60	40

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
65	66	Male	18	48	59
60	61	Male	70	46	56
84	85	Female	21	54	57
67	68	Female	68	48	48
125	126	Female	31	70	77
132	133	Female	25	72	34
9	10	Female	30	19	72
18	19	Male	52	23	29
55	56	Male	47	43	41
75	76	Male	26	54	54
150	151	Male	43	78	17
104	105	Male	49	62	56
135	136	Female	29	73	88
137	138	Male	32	73	73
164	165	Male	50	85	26
76	77	Female	45	54	53
79	80	Female	49	54	42
197	198	Male	32	126	74
38	39	Female	36	37	26
24	25	Female	54	28	14
122	123	Female	40	69	58
195	196	Female	35	120	79
29	30	Female	23	29	87
19	20	Female	35	23	98

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
143	144	Female	32	76	87
86	87	Female	55	57	58

In [8]:
```
x=df.iloc[:,[3,4]].values
x
```

Out[8]:
```
array([[ 15,  39],
       [ 15,  81],
       [ 16,   6],
       [ 16,  77],
       [ 17,  40],
       [ 17,  76],
       [ 18,   6],
       [ 18,  94],
       [ 19,   3],
       [ 19,  72],
       [ 19,  14],
       [ 19,  99],
       [ 20,  15],
       [ 20,  77],
       [ 20,  13],
       [ 20,  79],
       [ 21,  35],
       [ 21,  66],
       [ 23,  29],
       [ 23,  98],
       [ 24,  35],
       [ 24,  73],
       [ 25,   5],
       [ 25,  73],
       [ 28,  14],
       [ 28,  82],
       [ 28,  32],
       [ 28,  61],
       [ 29,  31],
       [ 29,  87],
       [ 30,   4],
       [ 30,  73],
       [ 33,   4],
       [ 33,  92],
       [ 33,  14],
       [ 33,  81],
       [ 34,  17],
       [ 34,  73],
       [ 37,  26],
       [ 37,  75],
       [ 38,  35],
       [ 38,  92],
       [ 39,  36],
       [ 39,  61],
```

```
       [ 39,  28],
       [ 39,  65],
       [ 40,  55],
       [ 40,  47],
       [ 40,  42],
       [ 40,  42],
       [ 42,  52],
       [ 42,  60],
       [ 43,  54],
       [ 43,  60],
       [ 43,  45],
       [ 43,  41],
       [ 44,  50],
       [ 44,  46],
       [ 46,  51],
       [ 46,  46],
       [ 46,  56],
       [ 46,  55],
       [ 47,  52],
       [ 47,  59],
       [ 48,  51],
       [ 48,  59],
       [ 48,  50],
       [ 48,  48],
       [ 48,  59],
       [ 48,  47],
       [ 49,  55],
       [ 49,  42],
       [ 50,  49],
       [ 50,  56],
       [ 54,  47],
       [ 54,  54],
       [ 54,  53],
       [ 54,  48],
       [ 54,  52],
       [ 54,  42],
       [ 54,  51],
       [ 54,  55],
       [ 54,  41],
       [ 54,  44],
       [ 54,  57],
       [ 54,  46],
       [ 57,  58],
       [ 57,  55],
```

```
       [ 58,  60],
       [ 58,  46],
       [ 59,  55],
       [ 59,  41],
       [ 60,  49],
       [ 60,  40],
       [ 60,  42],
       [ 60,  52],
       [ 60,  47],
       [ 60,  50],
       [ 61,  42],
       [ 61,  49],
       [ 62,  41],
       [ 62,  48],
       [ 62,  59],
       [ 62,  55],
       [ 62,  56],
       [ 62,  42],
       [ 63,  50],
       [ 63,  46],
       [ 63,  43],
       [ 63,  48],
       [ 63,  52],
       [ 63,  54],
       [ 64,  42],
       [ 64,  46],
       [ 65,  48],
       [ 65,  50],
       [ 65,  43],
       [ 65,  59],
       [ 67,  43],
       [ 67,  57],
       [ 67,  56],
       [ 67,  40],
       [ 69,  58],
       [ 69,  91],
       [ 70,  29],
       [ 70,  77],
       [ 71,  35],
       [ 71,  95],
       [ 71,  11],
       [ 71,  75],
       [ 71,   9],
       [ 71,  75],
```

```
       [ 72,  34],
       [ 72,  71],
       [ 73,   5],
       [ 73,  88],
       [ 73,   7],
       [ 73,  73],
       [ 74,  10],
       [ 74,  72],
       [ 75,   5],
       [ 75,  93],
       [ 76,  40],
       [ 76,  87],
       [ 77,  12],
       [ 77,  97],
       [ 77,  36],
       [ 77,  74],
       [ 78,  22],
       [ 78,  90],
       [ 78,  17],
       [ 78,  88],
       [ 78,  20],
       [ 78,  76],
       [ 78,  16],
       [ 78,  89],
       [ 78,   1],
       [ 78,  78],
       [ 78,   1],
       [ 78,  73],
       [ 79,  35],
       [ 79,  83],
       [ 81,   5],
       [ 81,  93],
       [ 85,  26],
       [ 85,  75],
       [ 86,  20],
       [ 86,  95],
       [ 87,  27],
       [ 87,  63],
       [ 87,  13],
       [ 87,  75],
       [ 87,  10],
       [ 87,  92],
       [ 88,  13],
       [ 88,  86],
```

```
       [ 88,  15],
       [ 88,  69],
       [ 93,  14],
       [ 93,  90],
       [ 97,  32],
       [ 97,  86],
       [ 98,  15],
       [ 98,  88],
       [ 99,  39],
       [ 99,  97],
       [101,  24],
       [101,  68],
       [103,  17],
       [103,  85],
       [103,  23],
       [103,  69],
       [113,   8],
       [113,  91],
       [120,  16],
       [120,  79],
       [126,  28],
       [126,  74],
       [137,  18],
       [137,  83]], dtype=int64)
```

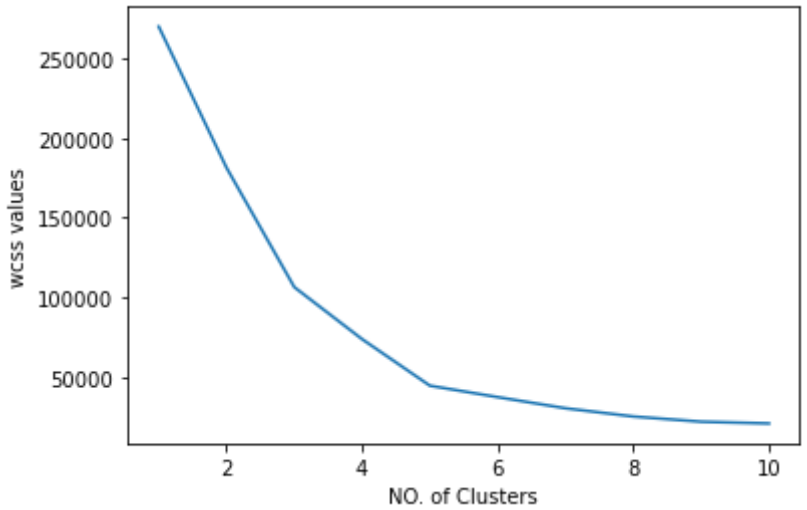
In [9]:

```
from sklearn.cluster import KMeans
wcss = []
for i in range(1,11):
    kmeans = KMeans(n_clusters=i, init='k-means++',random_state = 0)
    kmeans.fit(x)
    wcss.append(kmeans.inertia_)
wcss
```

```
C:\Users\DELL\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:1036: UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there are less chunks than available threads. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

Out[9]:
```
[269981.28,
 181363.59595959593,
 106348.37306211118,
 73679.78903948836,
 44448.45544793371,
 37265.86520484347,
 30259.65720728547,
 25095.703209997548,
 21830.041978049438,
 20736.679938924124]
```

In [10]:
```
plt.plot(range(1,11),wcss)
plt.xlabel("NO. of Clusters")
plt.ylabel("wcss values")
plt.show()
```

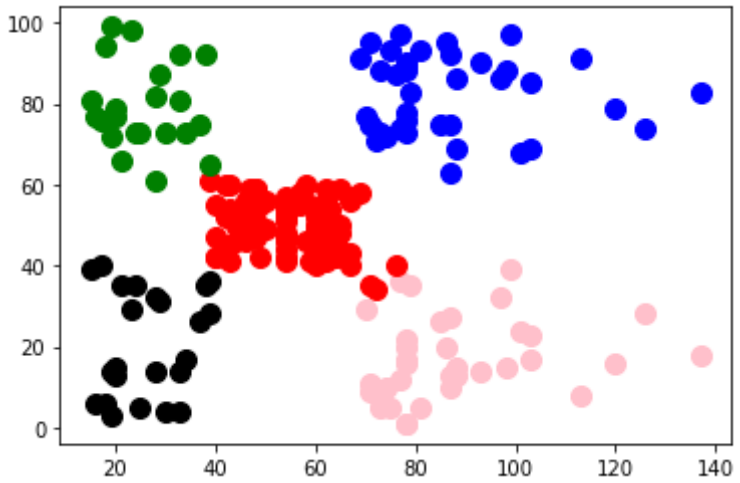


In [11]:
```
kmeans= KMeans(n_clusters=5, init='k-means++', random_state=0)
y_means = kmeans.fit_predict(x)
y_means
```

Out[11]:
```
array([4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4,
       4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 1,
       4, 3, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 0, 2, 1, 2, 0, 2, 0, 2,
       1, 2, 0, 2, 0, 2, 0, 2, 0, 2, 1, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2,
       0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2,
       0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2,
       0, 2])
```

In [12]:
```
plt.scatter(x[y_means == 0,0], x[y_means == 0,1], s=100, c='pink',label='clustering')
plt.scatter(x[y_means == 1,0], x[y_means == 1,1], s=100, c='red',label='clustering')
plt.scatter(x[y_means == 2,0], x[y_means == 2,1], s=100, c='blue',label='clustering')
plt.scatter(x[y_means == 3,0], x[y_means == 3,1], s=100, c='green',label='clustering')
plt.scatter(x[y_means == 4,0], x[y_means == 4,1], s=100, c='black',label='clustering')
```

Out[12]:
```
<matplotlib.collections.PathCollection at 0x23f1660fd00>
```



In [13]:
```
from sklearn.model_selection import KFold
kfs = KFold(n_splits=5,shuffle=False,random_state=None)
for train_data_index, test_data_index in kfs.split(df):
    print(train_data_index, test_data_index)
```

```
[ 40  41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57
  58  59  60  61  62  63  64  65  66  67  68  69  70  71  72  73  74  75
  76  77  78  79  80  81  82  83  84  85  86  87  88  89  90  91  92  93
  94  95  96  97  98  99 100 101 102 103 104 105 106 107 108 109 110 111
 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129
 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147
 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165
 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183
 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199] [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 2
0 21 22 23
 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39]
[  0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17
  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35
  36  37  38  39  80  81  82  83  84  85  86  87  88  89  90  91  92  93
  94  95  96  97  98  99 100 101 102 103 104 105 106 107 108 109 110 111
 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129
 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147
 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165
 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183
 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199] [40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 6
0 61 62 63
 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79]
[  0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17
  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35
  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53
  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70  71
  72  73  74  75  76  77  78  79 120 121 122 123 124 125 126 127 128 129
 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147
 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165
 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183
 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199] [ 80  81  82  83  84  85  86  87  88  89  90  91  92  93  94
95  96  97
  98  99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115
 116 117 118 119]
[  0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17
  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35
  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53
  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70  71
  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87  88  89
  90  91  92  93  94  95  96  97  98  99 100 101 102 103 104 105 106 107
 108 109 110 111 112 113 114 115 116 117 118 119 160 161 162 163 164 165
 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183
 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199] [120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 1
35 136 137
```

```
 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155
 156 157 158 159]
[  0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17
  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35
  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53
  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70  71
  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87  88  89
  90  91  92  93  94  95  96  97  98  99 100 101 102 103 104 105 106 107
 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159] [160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 1
75 176 177
 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195
 196 197 198 199]
```