In [1]:
```
import numpy as np
import pandas as pd
from sklearn.metrics import classification_report, confusion_matrix
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import f1_score

import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:
```
df=pd.read_csv('prefinaloutput.csv')
```

In [3]:
```
df.head(50)
```

Out[3]:

	amount	oldbalanceOrg	oldbalanceDest	isFraud	isFlaggedFraud for Operations	Time	Instrument or Mode_CREDIT-CARD	M
0	0.000121	0.000864	0.000000	0	0	0.939583	1	
1	0.000930	0.001620	0.000000	0	1	0.918056	1	
2	0.055328	0.019373	0.358175	0	1	0.203472	0	
3	0.013412	0.552665	0.846995	0	1	0.530556	0	
4	0.000895	0.001013	0.000000	0	1	0.322917	1	
5	0.000243	0.000427	0.000000	0	0	0.354167	1	
6	0.001011	0.004672	0.000000	0	1	0.791667	1	
7	0.000022	0.007654	0.000000	0	0	0.984722	1	
8	0.010432	0.019373	0.010583	0	1	0.386806	0	
9	0.062700	0.019373	0.247145	0	1	0.856250	0	
10	0.018434	0.245232	0.508086	0	1	0.461806	0	
11	0.008400	0.325994	1.000000	0	1	0.483333	0	
12	0.011435	0.019373	0.023937	0	1	0.268056	0	
13	0.014191	0.019373	0.568306	0	1	0.084722	0	
14	0.002054	0.000939	0.000000	0	1	0.593750	1	
15	0.002112	0.001364	0.005596	0	1	0.695139	0	
16	0.007724	0.000077	0.025762	0	1	0.904167	0	
17	0.000008	0.001629	0.000000	0	0	0.293750	1	
18	0.000783	0.001140	0.000000	0	1	0.611806	1	
19	0.027621	0.531522	0.017031	0	1	0.856944	0	
20	0.000504	0.001821	0.000000	0	1	0.457639	1	
21	0.001168	0.000076	0.000000	0	1	0.024306	1	
22	0.012354	0.945736	0.013058	0	1	0.551389	0	
23	0.020224	0.527536	0.013042	0	1	0.526389	0	
24	0.002420	0.003227	0.000000	0	1	0.290278	1	
25	0.000698	0.000794	0.000000	0	1	0.600000	1	
26	0.000287	0.000011	0.000000	0	0	0.132639	1	
27	0.005498	0.001646	0.002396	0	1	0.340972	0	
28	0.026164	0.019373	0.325268	0	1	0.960417	0	
29	0.001251	0.019373	0.000000	0	1	0.002083	1	
30	0.003738	0.001610	0.003891	0	1	0.276389	0	

	amount	oldbalanceOrg	oldbalanceDest	isFraud	isFlaggedFraud for Operations	Time	Instrument or Mode_CREDIT-CARD	M
31	0.052143	0.019373	0.085251	0	1	0.809028	0	
32	0.000403	0.000463	0.000000	0	0	0.370833	1	
33	0.000019	0.002400	0.000000	0	0	0.174306	1	
34	0.000048	0.000168	0.000000	0	0	0.689583	1	
35	0.002425	0.000465	0.000000	0	1	0.918056	1	
36	0.011753	0.687853	0.016835	0	1	0.538889	0	
37	0.023077	0.706116	0.026484	0	1	0.475000	0	
38	0.000336	0.000693	0.000000	0	0	0.450694	1	
39	0.003391	0.017888	0.562842	0	1	0.631250	0	
40	0.001476	0.019373	0.000000	0	1	0.031250	1	
41	0.011776	0.626915	0.014575	0	1	0.863889	0	
42	0.005056	0.000004	0.000000	0	1	0.644444	0	
43	0.005074	0.019373	0.000000	0	1	0.918750	1	
44	0.038094	0.194751	0.253290	0	1	0.519444	0	
45	0.000013	0.000020	0.000000	0	0	0.230556	1	
46	0.000403	0.002252	0.000000	0	0	0.678472	1	
47	0.002363	0.354576	0.016878	0	1	0.015278	0	
48	0.017088	0.002429	0.000000	0	1	0.227083	0	
49	0.023968	0.013110	0.573770	0	1	0.177778	0	

In [4]:
```
X=df.drop('isFraud',axis=1)
```

In [5]:
```
X
```

Out[5]:

	amount	oldbalanceOrg	oldbalanceDest	isFlaggedFraud for Operations	Time	Instrument or Mode_CREDIT-CARD	Instrun Mode_DE C/
0	0.000121	0.000864	0.000000	0	0.939583	1	
1	0.000930	0.001620	0.000000	1	0.918056	1	
2	0.055328	0.019373	0.358175	1	0.203472	0	
3	0.013412	0.552665	0.846995	1	0.530556	0	
4	0.000895	0.001013	0.000000	1	0.322917	1	
...	...	...	...	...	...	...	
994	0.000877	0.004998	0.000000	1	0.056250	1	
995	0.013326	0.193793	0.003701	1	0.050694	0	
996	0.002676	0.002068	0.005572	1	0.995833	0	
997	0.003723	0.010631	0.298527	1	0.349306	0	
998	0.006072	0.004700	0.000000	1	0.605556	0	

999 rows × 17 columns

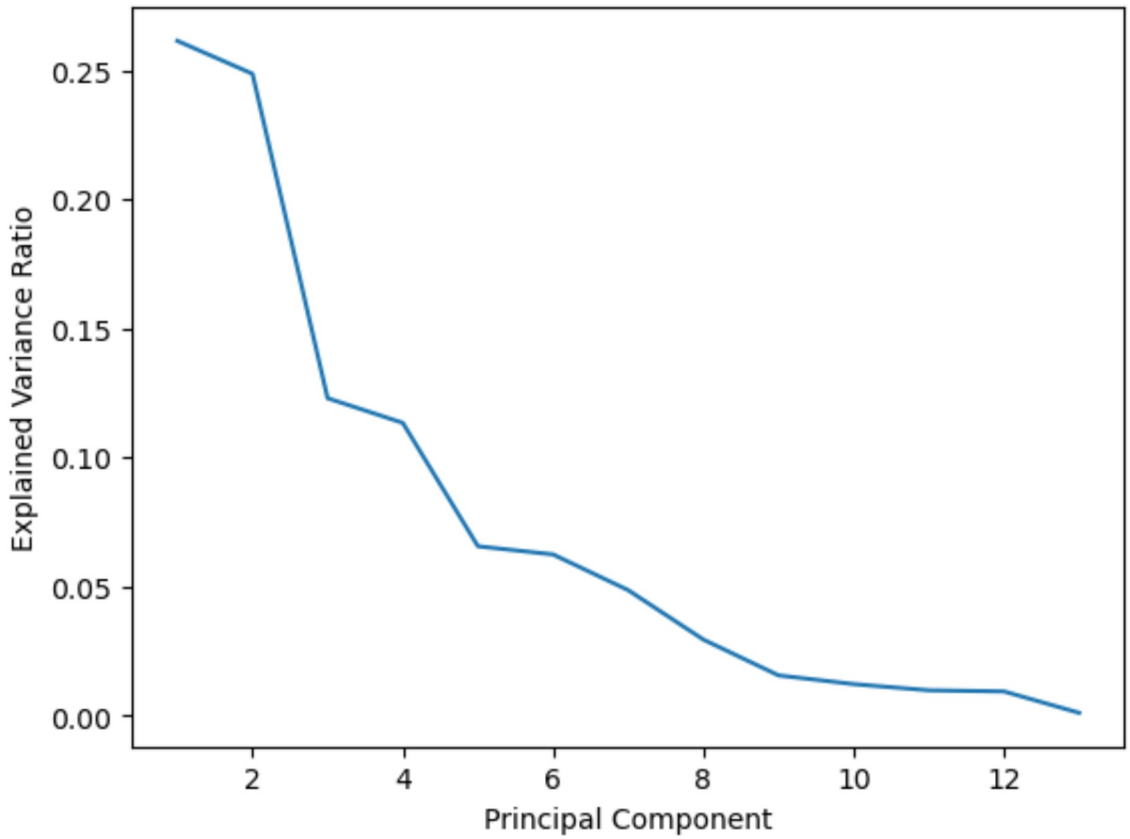
In [6]:
```
y=df['isFraud']
```

In [7]:
```
from sklearn.decomposition import PCA
pca = PCA(n_components=13)
```

In [8]:
```
pca.fit(X)
X_pca = pca.transform(X)
X_pca
```

Out[8]:
```
array([[-0.96201235, -0.47023336, -0.55869341, ..., -0.06354365,
        -0.02744263,  0.00986827],
       [-0.71830703, -0.54848174,  0.18092689, ...,  0.05657345,
         0.12236438,  0.00328062],
       [ 0.93026908, -0.8686877 ,  0.73396292, ..., -0.11562294,
         0.17822101, -0.00666587],
       ...,
       [ 1.00081662,  1.12656688,  0.19373739, ..., -0.10453852,
        -0.24715737,  0.00740208],
       [ 0.57540244, -0.80854093,  0.4119488 , ..., -0.27245355,
        -0.03850355, -0.01063136],
       [ 1.32126537,  1.06403993,  0.20211662, ...,  0.10518489,
        -0.11056074, -0.04361601]])
```

In [9]:
```
plt.plot(range(1, pca.n_components_ + 1), pca.explained_variance_ratio_)
plt.xlabel('Principal Component')
plt.ylabel('Explained Variance Ratio')
plt.show()
```

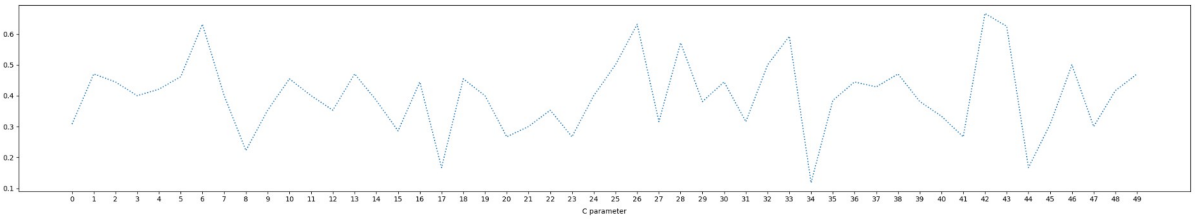


In [10]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y,stratify=y, test_size = 0.
svclassifier = SVC(C=1000.0,kernel='poly',gamma= 1,degree=2)
svclassifier.fit(X_train, y_train)
y_pred = svclassifier.predict(X_test)
print(confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))
```

```
[[238   2]
 [  5   5]]
              precision    recall  f1-score   support

           0       0.98      0.99      0.99       240
           1       0.71      0.50      0.59        10

    accuracy                           0.97       250
   macro avg       0.85      0.75      0.79       250
weighted avg       0.97      0.97      0.97       250
```

In [11]:
```
cresult=[]
ci=[]
for j in range(50):
    X_train, X_test, y_train, y_test = train_test_split(X, y,stratify=y, test_size
    svclassifier = SVC(C=1000.0,kernel='poly',gamma= 1,degree=2)
    svclassifier.fit(X_train, y_train)
    y_pred = svclassifier.predict(X_test)
    cresult.append(f1_score(y_test,y_pred))
    ci.append(j)

print("average of f1 score "+str(np.mean(cresult)))
plt.figure().set_figwidth(30)
plt.plot(cresult, linestyle = 'dotted')
plt.xticks(range(len(ci)), ci)
plt.xlabel("C parameter", labelpad=7)
plt.show()
```

```
average of f1 score 0.4009013879710474
```

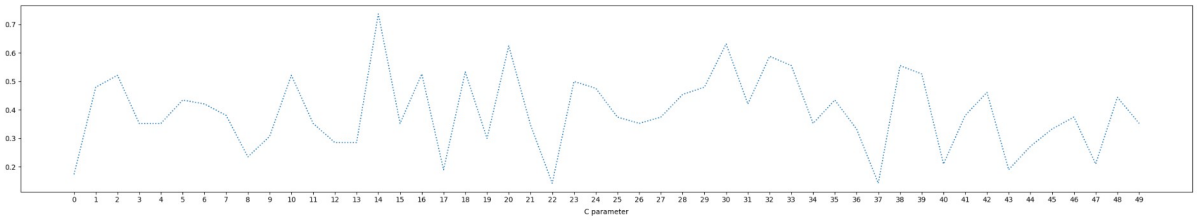


In [12]:
```
X_train, X_test, y_train, y_test = train_test_split(X_pca, y,stratify=y, test_size
svclassifier = SVC(C=1000.0,kernel='poly',gamma= 1,degree=2)
svclassifier.fit(X_train, y_train)
y_pred = svclassifier.predict(X_test)
print(confusion_matrix(y_test,y_pred))
print(classification_report(y_test,y_pred))
```

```
[[237   3]
 [  7   3]]
              precision    recall  f1-score   support

           0       0.97      0.99      0.98       240
           1       0.50      0.30      0.37        10

    accuracy                           0.96       250
   macro avg       0.74      0.64      0.68       250
weighted avg       0.95      0.96      0.96       250
```

In [13]:
```
cresult=[]
ci=[]
for j in range(50):
    X_train, X_test, y_train, y_test = train_test_split(X_pca, y,stratify=y, test_s
    svclassifier = SVC(C=1000.0,kernel='poly',gamma= 1,degree=2)
    svclassifier.fit(X_train, y_train)
    print(j,end=" ")
    y_pred = svclassifier.predict(X_test)
    cresult.append(f1_score(y_test,y_pred))
    ci.append(j)

print("average of f1 score "+str(np.mean(cresult)))
plt.figure().set_figwidth(30)
plt.plot(cresult, linestyle = 'dotted')
plt.xticks(range(len(ci)), ci)
plt.xlabel("C parameter", labelpad=7)
plt.show()
```

```
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 average of f1 score 0.3930
272062063958
```



In [ ]: