In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.metrics import (
   precision_score, recall_score, accuracy_score, f1_score,
   confusion_matrix, ConfusionMatrixDisplay,roc_curve,auc
)
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import GaussianNB
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
```

In [3]:
```
pre_data = pd.read_csv(r"C:\\Users\\TATIREDDY\\Documents\\NareshIT\\preprocessd
```

In [5]:
```
X = pre_data.drop('churn', axis=1)
y = pre_data['churn']
```

In [7]:
```
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=1
```

In [11]:
```
# model developement
models={'Decission Tree':DecisionTreeClassifier(),
       'KNN':KNeighborsClassifier(),
       'Logistic Reg':LogisticRegression(),
       'Naive Bayes':GaussianNB(),
       'Random Forest':RandomForestClassifier(),
       'SVM':SVC(probability=True)
 }
```

In [13]:
```
m=models.items()
m
```

Out[13]:
```
dict_items([('Decission Tree', DecisionTreeClassifier()), ('KNN', KNeighborsCla
ssifier()), ('Logistic Reg', LogisticRegression()), ('Naive Bayes', GaussianNB
()), ('Random Forest', RandomForestClassifier()), ('SVM', SVC(probability=Tru
e))])
```

In [15]:
```
results={}
roc_data={}
for name,model in m:
    model.fit(X_train,y_train)
    y_pred=model.predict(X_test)
    y_prob=model.predict_proba(X_test)[:,1]
    acc=accuracy_score(y_test, y_pred)
    prec=precision_score(y_test, y_pred)
    rec=recall_score(y_test, y_pred)
    f1=f1_score(y_test, y_pred)
    fpr,tpr,_=roc_curve(y_test, y_prob)
    auc_score=auc(fpr, tpr)
    results[name]=[acc,prec,rec,f1,auc_score]
    roc_data[name]=(fpr,tpr)
 #print(results)
 #print(roc_data)
```

matrices data frame

In [24]:
```
metrics_df = pd.DataFrame(results, index=["Accuracy", "Precision", "Recall", "F
print(metrics_df)
```

```
                 Decission Tree       KNN  Logistic Reg  Naive Bayes  \
Accuracy               0.876833  0.879765      0.739003     0.775660
Precision              0.854749  0.813725      0.736686     0.789969
Recall                 0.905325  0.982249      0.736686     0.745562
F1 Score               0.879310  0.890080      0.736686     0.767123
confusion_matrix       0.877081  0.959397      0.807692     0.825882

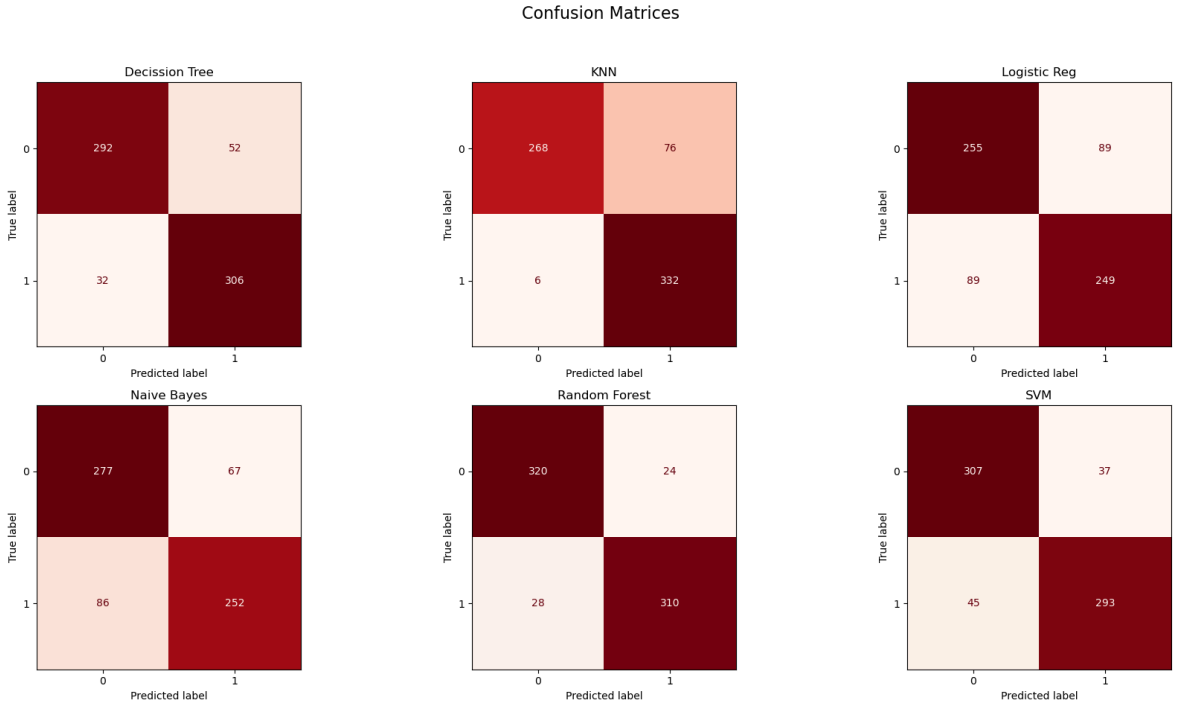
                 Random Forest       SVM
Accuracy              0.923754  0.879765
Precision             0.928144  0.887879
Recall                0.917160  0.866864
F1 Score              0.922619  0.877246
confusion_matrix      0.980249  0.927541
```

subplots

In [33]:
```
fig, axes = plt.subplots(2, 3, figsize=(18, 10))
axes = axes.ravel() # converts 1d array

for idx, (name, model) in enumerate(models.items()):

    y_pred = model.predict(X_test)
    cm = confusion_matrix(y_test, y_pred)
    disp = ConfusionMatrixDisplay(cm)
    disp.plot(ax=axes[idx], cmap='Reds', colorbar=False)
    axes[idx].set_title(name)
plt.suptitle("Confusion Matrices", fontsize=16)
plt.tight_layout(rect=[0, 0.03, 1, 0.95]) #it avoids overlapping between two plo
plt.show()
```



In [35]:
```
axes
```

Out[35]:
```
array([<Axes: title={'center': 'Decission Tree'}, xlabel='Predicted label', yla
bel='True label'>,
       <Axes: title={'center': 'KNN'}, xlabel='Predicted label', ylabel='True l
abel'>,
       <Axes: title={'center': 'Logistic Reg'}, xlabel='Predicted label', ylabe
l='True label'>,
       <Axes: title={'center': 'Naive Bayes'}, xlabel='Predicted label', ylabel
='True label'>,
       <Axes: title={'center': 'Random Forest'}, xlabel='Predicted label', ylab
el='True label'>,
       <Axes: title={'center': 'SVM'}, xlabel='Predicted label', ylabel='True l
abel'>],
      dtype=object)
```

In [37]:
```
idx
```

Out[37]:
```
5
```

In [39]:
```
axes[idx]
```

Out[39]:
```
<Axes: title={'center': 'SVM'}, xlabel='Predicted label', ylabel='True label'>
```

In [45]:
```
roc_data
```

Out[45]:

```
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        1.        , 1.        ])),
 'Logistic Reg': (array([0.        , 0.        , 0.        , 0.00290698, 0.0029
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```

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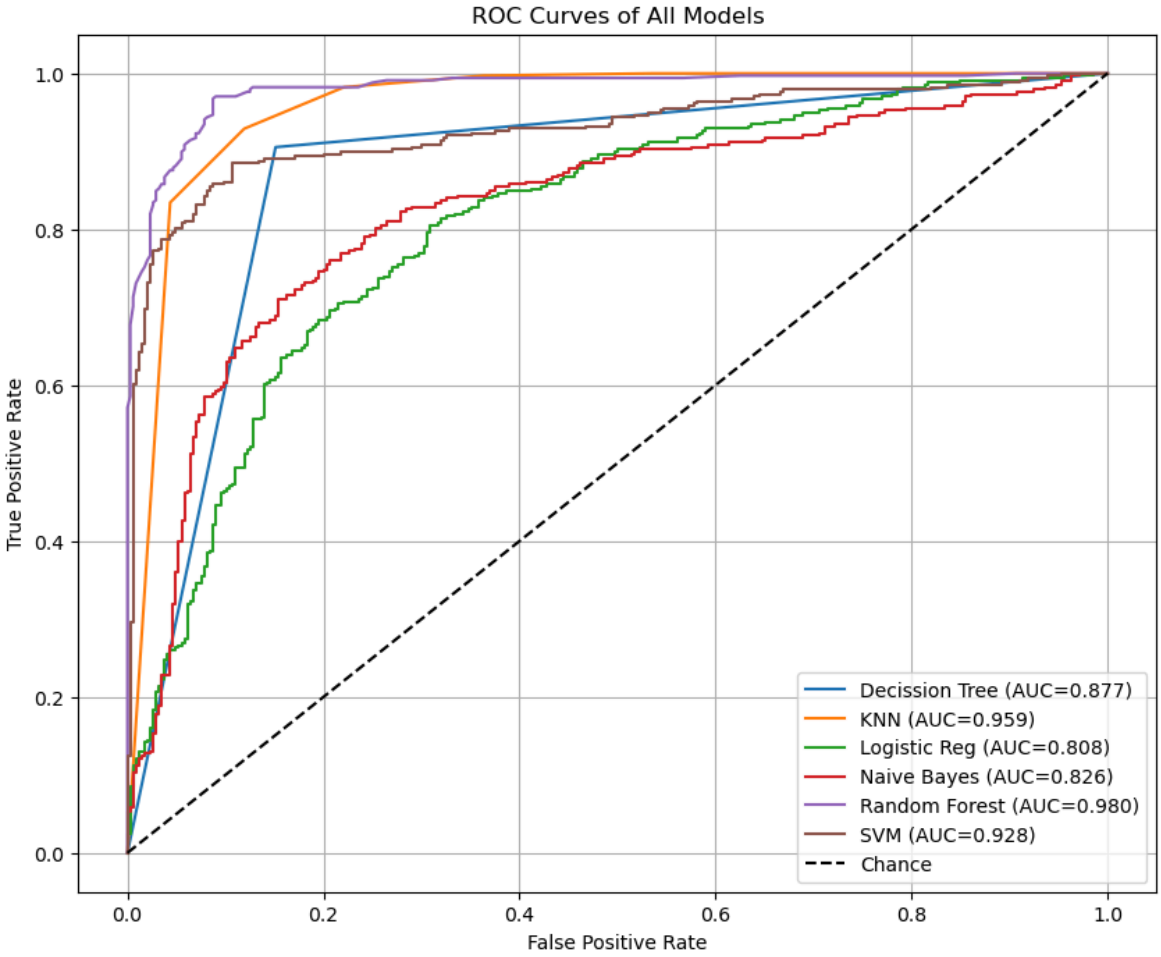
        1.        ]))}
```

In [51]:

```
plt.figure(figsize=(10, 8))
for name, (fpr, tpr) in roc_data.items():

    auc_val = auc(fpr, tpr)
    plt.plot(fpr, tpr, label=f"{name} (AUC={auc_val:.3f})") #3f=after pt 3 pt
plt.plot([0, 1], [0, 1], 'k--', label='Chance')
plt.title("ROC Curves of All Models")
plt.xlabel("False Positive Rate")
plt.ylabel("True Positive Rate")
plt.legend()
```

```
plt.grid()
plt.show()
```



In [ ]: