In [3]:

```
import numpy as np
import matplotlib.pyplot as plt
import sklearn
import sklearn.tree
import sklearn.metrics
import sklearn.ensemble
import sklearn.preprocessing
import sklearn.model_selection   # For cross_val_score, GridSearchCV, RandomizedSea
import pandas as pd
plt.rcParams.update({'figure.max_open_warning': 0})
```

In [4]:

```
import importlib
def train_estimators(X, y, estimator_type, param_name, param_vals, **kwargs):
    train_estimator = []
    s = "%s" %kwargs #converts kwargs to string
    s = str(estimator_type).split("'")[1]      #gets import_module which is sklearn
    position1 = (s.find("."))
    position2 = (s.find(".",position1+1))

    for i in range(len(param_vals)):
        model_class = getattr(importlib.import_module(s[:position2]),(str(estimator_
        kwargs[param_name] = param_vals[i] #adds param_name into the kwargs diction
        model = model_class(**kwargs)  # instantiates the model
        train_estimator.append(model.fit(X,y))
        #print(f' Training {train_estimator[i]}...')
    return train_estimator

def score_estimators(X, y, estimators):
    score = []
    for i in range(np.array(estimators).shape[0]):
         score.append(estimators[i].score(X,y))
    return score

def plot_estimator_scores(estimators, param_name, param_vals, X_trn, ytrn, X_val, y
    train_score,val_score,test_score = [],[],[]
    train_score = np.average([score_estimators(X_trn,ytrn,e) for e in estimators], a
    val_score = np.average([score_estimators(X_val,yval,e) for e in estimators], ax
    test_score = np.average([score_estimators(X_test,ytest,e) for e in estimators],
    #print(np.array([score_estimators(X_test,ytest,e) for e in estimators]))
    #print(test_score)
    #finding best scores
    best_val = max(np.array(val_score))
    index = val_score.index(best_val)

    best_train = train_score[index]
    best_test = test_score[index]

    min_score = np.concatenate((train_score,val_score,test_score))
    best_score = np.concatenate((train_score,val_score,test_score))
    #plotting code
    #makes sure the x axis points are evenly spaced
    locs, labels = plt.xticks()
    plt.plot(locs,np.array(train_score).ravel(),'-o',color='green',label='train = %
    plt.plot(locs,val_score,'-o',color='red',label='validate = %.3f' %(best_val))
    plt.plot(locs,test_score,linestyle='dotted',color='black',label='test = %.3f' %

    plt.scatter(locs[index],best_val, s=150, marker='x',color="red")
    plt.xticks(locs,param_vals)
    #plt.ylim(min(min_score)-0.02,max(best_score)+0.01)
    plt.ylim(0,1)
    plt.legend(loc="center left")
    plt.xlabel(param_name)
    plt.ylabel("score")
    plt.title(f'({name}) {estimators[0].__class__.__name__} score vs {param_name}')
```

In [5]:

```
import numpy as np
import matplotlib.pyplot as plt
import sklearn
import sklearn.tree
import sklearn.metrics
import sklearn.ensemble
import sklearn.preprocessing
import sklearn.model_selection   # For cross_val_score, GridSearchCV, RandomizedSea
import pandas as pd
import warnings
plt.rcParams.update({'figure.max_open_warning': 0})
from sklearn.model_selection import TimeSeriesSplit
from sklearn.model_selection import cross_val_score

estimators = {}

def trainForY(X, data, yname):
    print('============================================================')
    print(yname)
    estimators[yname] = {}

    y = data[yname]
    y = y.values
    tscv = TimeSeriesSplit()
    #(trn_1, tst_1), (trn_2, tst_2), (trn_3, tst_3), (trn_4, tst_4), (trn_5, tst_5)
    #X_trn_1, X_val_1, y_trn_1, y_val_1 = sklearn.model_selection.train_test_split(
    #X_trn_2, X_val_2, y_trn_2, y_val_2 = sklearn.model_selection.train_test_split(
    ###X_trn_3, X_val_3, y_trn_3, y_val_3 = sklearn.model_selection.train_test_spli
    ##X_trn_4, X_val_4, y_trn_4, y_val_4 = sklearn.model_selection.train_test_split
    #X_trn_5, X_val_5, y_trn_5, y_val_5 = sklearn.model_selection.train_test_split(

    #cv_results = cross_val_score( sklearn.linear_model.LogisticRegression(), X, y,
    #print(cv_results)
    #return


    tree_estimators =  [[], [], [], [], [], []]
    forest =  [[], [], [], [], [], []]
    logistic =  [[], [], [], [], [], []]
    svm =  [[], [], [], [], [], []]

    warnings.filterwarnings('ignore', 'Solver terminated early.*')
    it = 1
    print(f'Total length: {len(X)}')
    for train_index, test_index in tscv.split(X):
        print('----------------------------')
        print(f'Iteration {it}')
        it += 1
        X_trn, X_tst = X[train_index], X[test_index]
        y_trn, y_tst = y[train_index], y[test_index]
        val_split = round(len(X_trn)*.75)
        X_val = X_trn[val_split:]
        X_trn = X_trn[:val_split]
        y_val = y_trn[val_split:]
        y_trn = y_trn[:val_split]
        print(f'Training length: {len(X_trn)}')
        print(f'Validation length: {len(X_val)}')
        print(f'Test length: {len(X_tst)}')
        #X_trn, X_val, y_trn, y_val = sklearn.model_selection.train_test_split(X_tr
```

```
        scaler = sklearn.preprocessing.StandardScaler()
        X_trn = scaler.fit_transform(X_trn.reshape(X_trn.shape[0],-1))
        X_test = scaler.transform(X_tst.reshape(X_tst.shape[0],-1))
        X_val = scaler.transform(X_val.reshape(X_val.shape[0],-1))

        print("trees...")
        tree_estimators_temp = train_estimators(X_trn, y_trn, sklearn.tree.Decision
        for i, est in enumerate(tree_estimators_temp):
            tree_estimators[i].append(est)

        print("forests...")
        forest_temp = train_estimators(X_trn, y_trn, sklearn.ensemble.RandomForestC
        for i, est in enumerate(forest_temp):
            forest[i].append(est)

        print("logistic...")
        logistic_temp = train_estimators(X_trn, y_trn, sklearn.linear_model.Logisti
        for i, est in enumerate(logistic_temp):
            logistic[i].append(est)

        print("svm...")
        svm_temp = train_estimators(X_trn, y_trn, sklearn.svm.SVC, 'C', [0.01, 0.1,
        for i, est in enumerate(svm_temp):
            svm[i].append(est)


    estimators[yname]['tree'] = tree_estimators
    estimators[yname]['forest'] = forest
    estimators[yname]['logistic'] = logistic
    estimators[yname]['svm'] = svm
    fig = plt.figure(figsize=(20,10))
    fig.suptitle(yname)
    fig.add_subplot(2,2,1)
    plot_estimator_scores(tree_estimators,'max_depth',[1, 5, 10, 20, 50, 100], X_tr
    fig.add_subplot(2,2,2)
    plot_estimator_scores(forest,'max_depth',[1, 5, 10, 20, 50, 100], X_trn, y_trn,
    fig.add_subplot(2,2,3)
    plot_estimator_scores(logistic,'C',[1e-05, 0.0001, 0.001, 0.01, 0.1, 1.0], X_tr
    fig.add_subplot(2,2,4)
    plot_estimator_scores(svm,'C',[0.01, 0.1,1.0, 10.0, 100.0,1000.0], X_trn, y_trn


def trainFromFile(file, yname):
    estimators ={}
    data = pd.read_csv(file)

    #data.drop(data.columns[data.columns.str.contains('unnamed',case = False)],axis
    #data = data.dropna(axis=1)
    #for col in data.columns:
    #    print(col)
    X = data.drop(["date","ticker", 'close', 'today_close',
                   "tomorrw_is_buy","tomorrow_is_strong_buy", "tomorrow_increase","
                   "week_is_buy","week_is_strong_buy",  "week_increase",
                   "4week_is_buy", "4week_close", "4week_is_strong_buy"],axis=1)
    #X = data.drop(["date","ticker"],axis=1)
    #print(X.head())

    for i, col in enumerate(X.columns):
        print(str(i) + ': ' + col)
    X = X.values
```

```
    trainForY(X, data, yname)
```

In [6]:

```
ests = [None] * 16
```

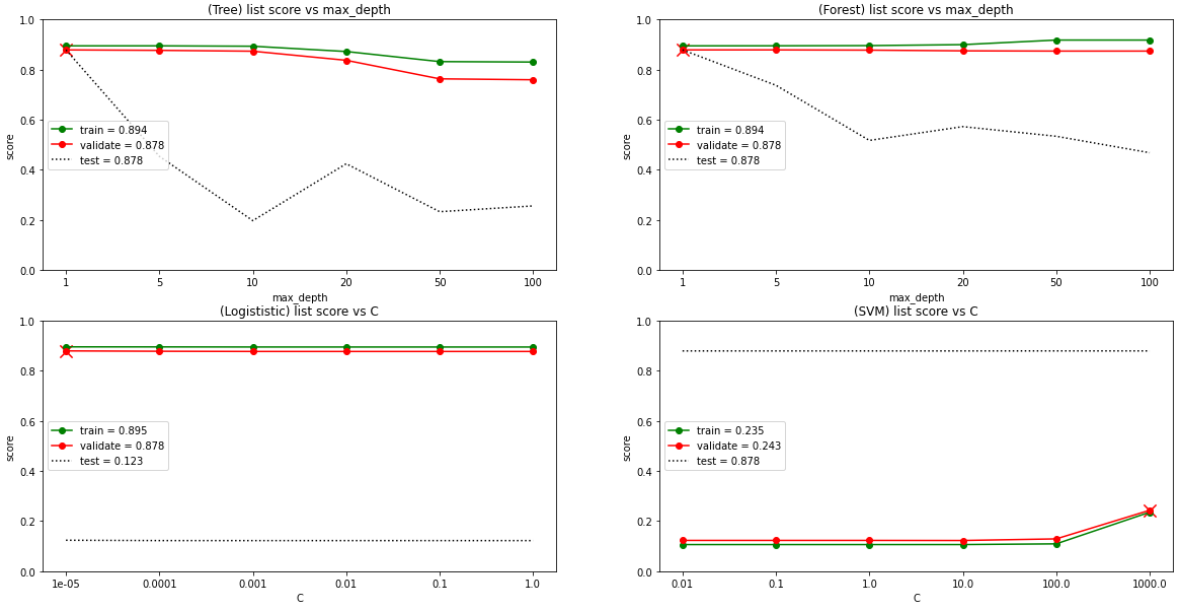
In [5]:

```
trainFromFile('out.csv', 'tomorrw_is_buy')
ests[0] = estimators
```

```
0: score_neg
1: score_neu
2: score_pos
3: score_compound
4: parent_score_neg
5: parent_score_neu
6: parent_score_pos
7: parent_score_compound
8: score
9: parent_score
10: submission_score
11: is_root
12: submission_ratio
13: parent_ratio
14: num_replies
15: day_increase
16: volume
============================================================
tomorrw_is_buy
Total length: 401598
---------------------------
Iteration 1
Training length: 50200
Validation length: 16733
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 2
Training length: 100400
Validation length: 33466
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 3
Training length: 150599
Validation length: 50200
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 4
Training length: 200799
Validation length: 66933
Test length: 66933
trees...
forests...
logistic...
svm...
```

```
--------------------------
Iteration 5
Training length: 250999
Validation length: 83666
Test length: 66933
trees...
forests...
logistic...
svm...
```

tomorrw_is_buy



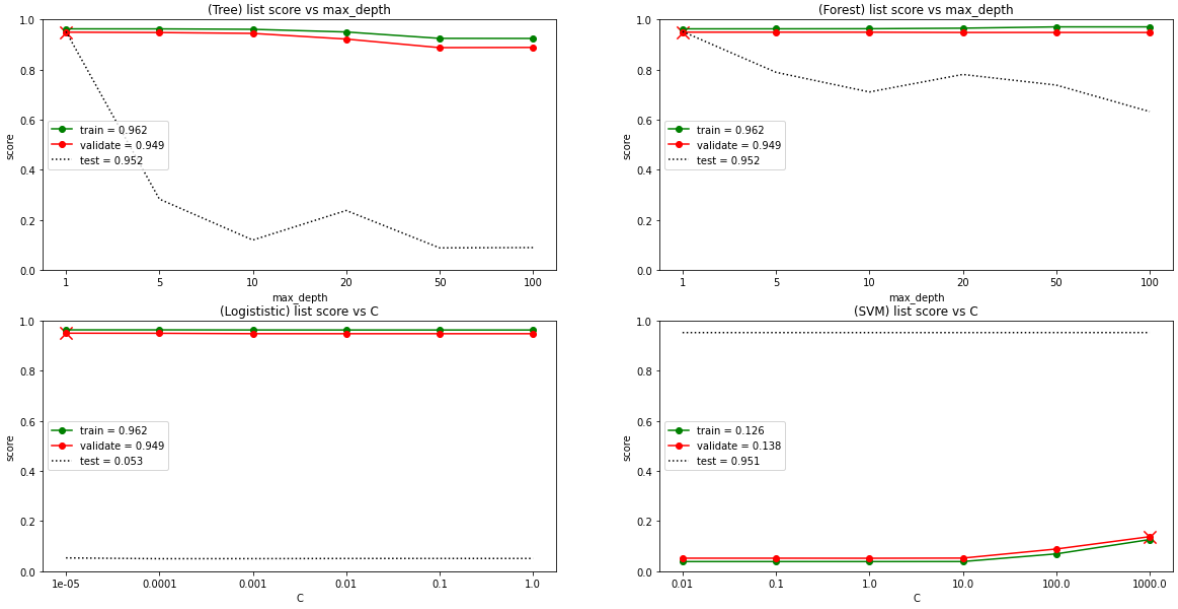
In [6]:

```
trainFromFile('out.csv', 'tomorrow_is_strong_buy')
ests[1] = estimators
```

```
0: score_neg
1: score_neu
2: score_pos
3: score_compound
4: parent_score_neg
5: parent_score_neu
6: parent_score_pos
7: parent_score_compound
8: score
9: parent_score
10: submission_score
11: is_root
12: submission_ratio
13: parent_ratio
14: num_replies
15: day_increase
16: volume
============================================================
tomorrow_is_strong_buy
Total length: 401598
---------------------------
Iteration 1
Training length: 50200
Validation length: 16733
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 2
Training length: 100400
Validation length: 33466
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 3
Training length: 150599
Validation length: 50200
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 4
Training length: 200799
Validation length: 66933
Test length: 66933
trees...
forests...
logistic...
svm...
```

```
--------------------------
Iteration 5
Training length: 250999
Validation length: 83666
Test length: 66933
trees...
forests...
logistic...
svm...
```

tomorrow_is_strong_buy

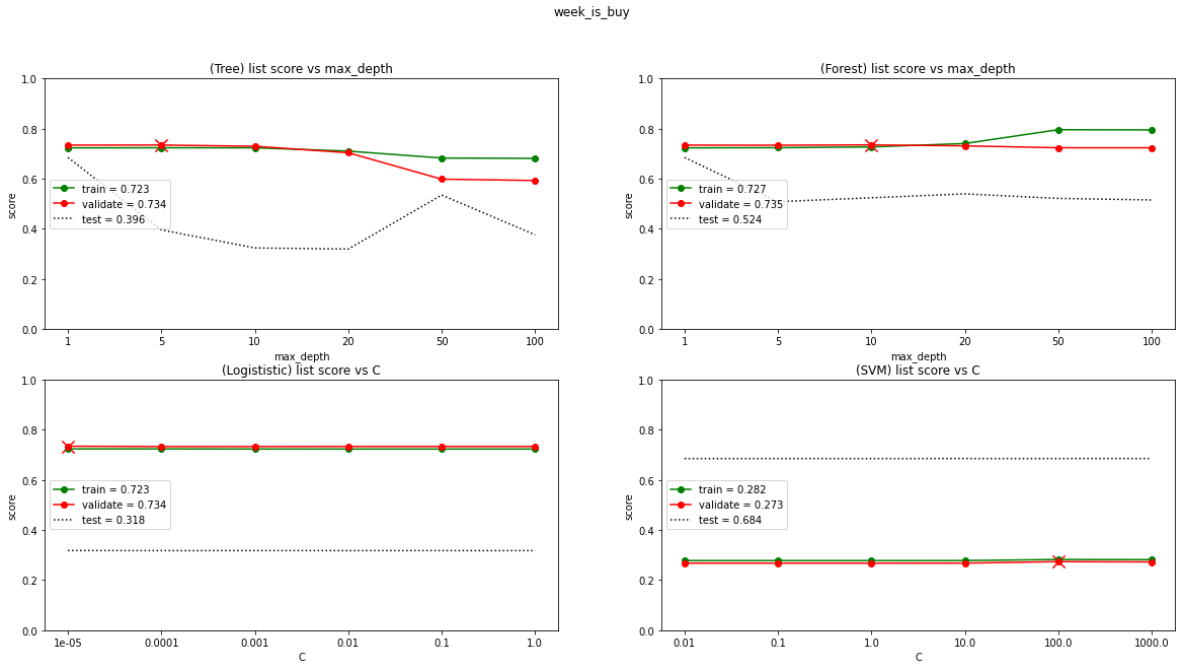


In [7]:

```
trainFromFile('out.csv', 'week_is_buy')
ests[2] = estimators
```

```
0: score_neg
1: score_neu
2: score_pos
3: score_compound
4: parent_score_neg
5: parent_score_neu
6: parent_score_pos
7: parent_score_compound
8: score
9: parent_score
10: submission_score
11: is_root
12: submission_ratio
13: parent_ratio
14: num_replies
15: day_increase
16: volume
============================================================
week_is_buy
Total length: 401598
---------------------------
Iteration 1
Training length: 50200
Validation length: 16733
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 2
Training length: 100400
Validation length: 33466
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 3
Training length: 150599
Validation length: 50200
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 4
Training length: 200799
Validation length: 66933
Test length: 66933
trees...
forests...
logistic...
svm...
```

```
--------------------------
Iteration 5
Training length: 250999
Validation length: 83666
Test length: 66933
trees...
forests...
logistic...
svm...
```



In [ ]:

```
%%time
trainFromFile('out.csv', 'week_is_strong_buy')
ests[3] = estimators
```

```
0: score_neg
1: score_neu
2: score_pos
3: score_compound
4: parent_score_neg
5: parent_score_neu
6: parent_score_pos
7: parent_score_compound
8: score
9: parent_score
10: submission_score
11: is_root
12: submission_ratio
13: parent_ratio
14: num_replies
15: day_increase
16: volume
============================================================
week_is_strong_buy
Total length: 401598
---------------------------
Iteration 1
Training length: 50200
Validation length: 16733
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 2
Training length: 100400
Validation length: 33466
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 3
Training length: 150599
Validation length: 50200
Test length: 66933
trees...
forests...
logistic...
svm...
---------------------------
Iteration 4
Training length: 200799
Validation length: 66933
Test length: 66933
trees...
forests...
logistic...
```

```
svm...
---------------------------
Iteration 5
Training length: 250999
Validation length: 83666
Test length: 66933
trees...
forests...
```

In [ ]:

```
%%time
trainFromFile('out.csv', '4week_is_buy')
ests[4] = estimators
```

In [ ]:

```
%%time
trainFromFile('out.csv', '4week_is_strong_buy')
ests[5] = estimators
```

In [ ]:

```
%%time
trainFromFile('out2.csv', 'tomorrw_is_buy')
ests[6] = estimators
```

In [ ]:

```
%%time
trainFromFile('out2.csv', 'tomorrow_is_strong_buy')
ests[7] = estimators
```

In [ ]:

```
%%time
trainFromFile('out2.csv', 'week_is_buy')
ests[8] = estimators
```

In [ ]:

```
%%time
trainFromFile('out2.csv', 'week_is_strong_buy')
ests[9] = estimators
```

In [ ]:

```
%%time
trainFromFile('out2.csv', '4week_is_buy')
ests[10] = estimators
```

In [ ]:

```
%%time
trainFromFile('out2.csv', '4week_is_strong_buy')
ests[11] = estimators
```

In [ ]:

```
for yname,v in temp.items():
    print(yname)
    #for cla,ests in v.items():
        #print([score_estimators(X_trn,ytrn,e) for e in ests])
    #print(v['tree'])
    for e in v['tree'][0]:
        #print(e)
        plt.figure()
        sklearn.tree.plot_tree(e)
    break
```