In [87]:
```
import sys
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.pyplot import figure


from pal.paldata import PalData
from pal.palmodel import PalModel
```

In [88]:
```
datasets = {"m2n4": [54000, 5900], # num train, test samples
        "m2n5" : [960000, 11830],
        "m2n6" : [300000,4990],
        "m2n7" : [120000, 5315]}
```

In [89]:
```
def paldata(m,n):

    print("preparing dataset...")
    pd = PalData(numProc=m, numTasks=n)

    pd.load_numpy_fromfile("data/paldata_m{}_n{}_ts_preproc.npy".f
ormat(m, n),
                            "data/paldata_m{}_n{}_tl_preproc.npy".
format(m, n))


    ds = datasets["m{}n{}".format(m, n)]
    X, Y = pd.next_batch(ds[0])
    X_test, Y_test = pd.next_batch(ds[1])

    return X,Y,X_test, Y_test

def paleval(m,n, X_test, Y_test):

    palmodel = PalModel(numProcs=m, numTasks=n, nb_epochs=60, lean
ring_rate=0.01)
    palmodel.load_model()

    accuracy, _, Y_test_hat_scheduable = palmodel.eval(X_test, Y_t
est)

    return accuracy, Y_test_hat_scheduable, palmodel
```

In [90]:
```
m=2
Xs = []
Ys = []
X_tests = []
Y_tests = []
num_Y_test_hat_samples = []
test_accs = []
train_accs = []

for n in [ 4,5,6,7 ]:
    print("----> Evaluate m{}n{} dataset".format(m,n))

    X, Y, X_test, Y_test = paldata(m,n)
    Xs.append(X)
    Ys.append(Y)
    X_tests.append(X_test)
    Y_tests.append(Y_test)

    print("---> Evaluate on training set")
    acc, _, _ = paleval(m,n, X, Y)
    train_accs.append(acc)

    print("---> Evaluate on test set")
    acc, Y_test_hat_scheduable, _= paleval(m,n, X_test, Y_test)
    test_accs.append(acc)
    num_Y_test_hat_samples.append(np.sum(Y_test_hat_scheduable))
```

```
----> Evaluate m2n4 dataset
preparing dataset...
Load #515910 tasksets from data/paldata_m2_n4_ts_preproc.npy and #
515910 tasks from file data/paldata_m2_n4_tl_preproc.npy
Acquired 54000 samples
Acquired 5900 samples
---> Evaluate on training set
Building PAL model...
Model: "model_82"
__________________________________________________________________
________________________________
Layer (type)                    Output Shape         Param #     C
onnected to
==================================================================
================================
main_input (InputLayer)         [(None, 4, 2)]       0
__________________________________________________________________
________________________________
encoder (LSTM)                  [(None, 4, 512), (No 1054720     m
ain_input[0][0]
__________________________________________________________________
________________________________
decoder (PointerLSTM)           (None, 4, None)      2624000     e
ncoder[0][0]
                                                                 e
ncoder[0][1]
                                                                 e
ncoder[0][2]
==================================================================
================================
Total params: 3,678,720
Trainable params: 3,678,720
Non-trainable params: 0
__________________________________________________________________
________________________________
None
---> Evaluate on test set
Building PAL model...
Model: "model_83"
__________________________________________________________________
________________________________
Layer (type)                    Output Shape         Param #     C
onnected to
==================================================================
================================
main_input (InputLayer)         [(None, 4, 2)]       0
__________________________________________________________________
________________________________
encoder (LSTM)                  [(None, 4, 512), (No 1054720     m
ain_input[0][0]
__________________________________________________________________
________________________________
decoder (PointerLSTM)           (None, 4, None)      2624000     e
ncoder[0][0]
                                                                 e
ncoder[0][1]
                                                                 e
ncoder[0][2]
```

```
==================================================================
================================
Total params: 3,678,720
Trainable params: 3,678,720
Non-trainable params: 0
__________________________________________________________________
________________________________
None
----> Evaluate m2n5 dataset
preparing dataset...
Load #971830 tasksets from data/paldata_m2_n5_ts_preproc.npy and #
971830 tasks from file data/paldata_m2_n5_tl_preproc.npy
Acquired 960000 samples
Acquired 11830 samples
---> Evaluate on training set
Building PAL model...
Model: "model_84"
__________________________________________________________________
________________________________
Layer (type)                    Output Shape         Param #     C
onnected to
==================================================================
================================
main_input (InputLayer)         [(None, 5, 2)]       0
__________________________________________________________________
________________________________
encoder (LSTM)                  [(None, 5, 512), (No 1054720     m
ain_input[0][0]
__________________________________________________________________
________________________________
decoder (PointerLSTM)           (None, 5, None)      2624000     e
ncoder[0][0]
                                                                 e
ncoder[0][1]
                                                                 e
ncoder[0][2]
==================================================================
================================
Total params: 3,678,720
Trainable params: 3,678,720
Non-trainable params: 0
__________________________________________________________________
________________________________
None
---> Evaluate on test set
Building PAL model...
Model: "model_85"
__________________________________________________________________
________________________________
Layer (type)                    Output Shape         Param #     C
onnected to
==================================================================
================================
main_input (InputLayer)         [(None, 5, 2)]       0
__________________________________________________________________
________________________________
encoder (LSTM)                  [(None, 5, 512), (No 1054720     m
ain_input[0][0]
__________________________________________________________________
```

```
________________________________
decoder (PointerLSTM)           (None, 5, None)      2624000     e
ncoder[0][0]
                                                                 e
ncoder[0][1]
                                                                 e
ncoder[0][2]
==================================================================
================================
Total params: 3,678,720
Trainable params: 3,678,720
Non-trainable params: 0
__________________________________________________________________
________________________________
None
----> Evaluate m2n6 dataset
preparing dataset...
Load #304990 tasksets from data/paldata_m2_n6_ts_preproc.npy and #
304990 tasks from file data/paldata_m2_n6_tl_preproc.npy
Acquired 300000 samples
Acquired 4990 samples
---> Evaluate on training set
Building PAL model...
Model: "model_86"
__________________________________________________________________
________________________________
Layer (type)                    Output Shape         Param #     C
onnected to
==================================================================
================================
main_input (InputLayer)         [(None, 6, 2)]       0
__________________________________________________________________
________________________________
encoder (LSTM)                  [(None, 6, 512), (No 1054720     m
ain_input[0][0]
__________________________________________________________________
________________________________
decoder (PointerLSTM)           (None, 6, None)      2624000     e
ncoder[0][0]
                                                                 e
ncoder[0][1]
                                                                 e
ncoder[0][2]
==================================================================
================================
Total params: 3,678,720
Trainable params: 3,678,720
Non-trainable params: 0
__________________________________________________________________
________________________________
None
---> Evaluate on test set
Building PAL model...
Model: "model_87"
__________________________________________________________________
________________________________
Layer (type)                    Output Shape         Param #     C
onnected to
==================================================================
================================
main_input (InputLayer)         [(None, 6, 2)]       0

__________________________________________________________________
________________________________
encoder (LSTM)                  [(None, 6, 512), (No 1054720     m
ain_input[0][0]

__________________________________________________________________
________________________________
decoder (PointerLSTM)           (None, 6, None)      2624000     e
ncoder[0][0]
                                                                 e
ncoder[0][1]
                                                                 e
ncoder[0][2]
==================================================================
================================
Total params: 3,678,720
Trainable params: 3,678,720
Non-trainable params: 0

__________________________________________________________________
________________________________
None
----> Evaluate m2n7 dataset
preparing dataset...
Load #125315 tasksets from data/paldata_m2_n7_ts_preproc.npy and #
125315 tasks from file data/paldata_m2_n7_tl_preproc.npy
Acquired 120000 samples
Acquired 5315 samples
---> Evaluate on training set
Building PAL model...
Model: "model_88"

__________________________________________________________________
________________________________
Layer (type)                    Output Shape         Param #     C
onnected to
==================================================================
================================
main_input (InputLayer)         [(None, 7, 2)]       0

__________________________________________________________________
________________________________
encoder (LSTM)                  [(None, 7, 512), (No 1054720     m
ain_input[0][0]

__________________________________________________________________
________________________________
decoder (PointerLSTM)           (None, 7, None)      2624000     e
ncoder[0][0]
                                                                 e
ncoder[0][1]
                                                                 e
ncoder[0][2]
==================================================================
================================
Total params: 3,678,720
Trainable params: 3,678,720
Non-trainable params: 0

__________________________________________________________________
________________________________
None
---> Evaluate on test set
```

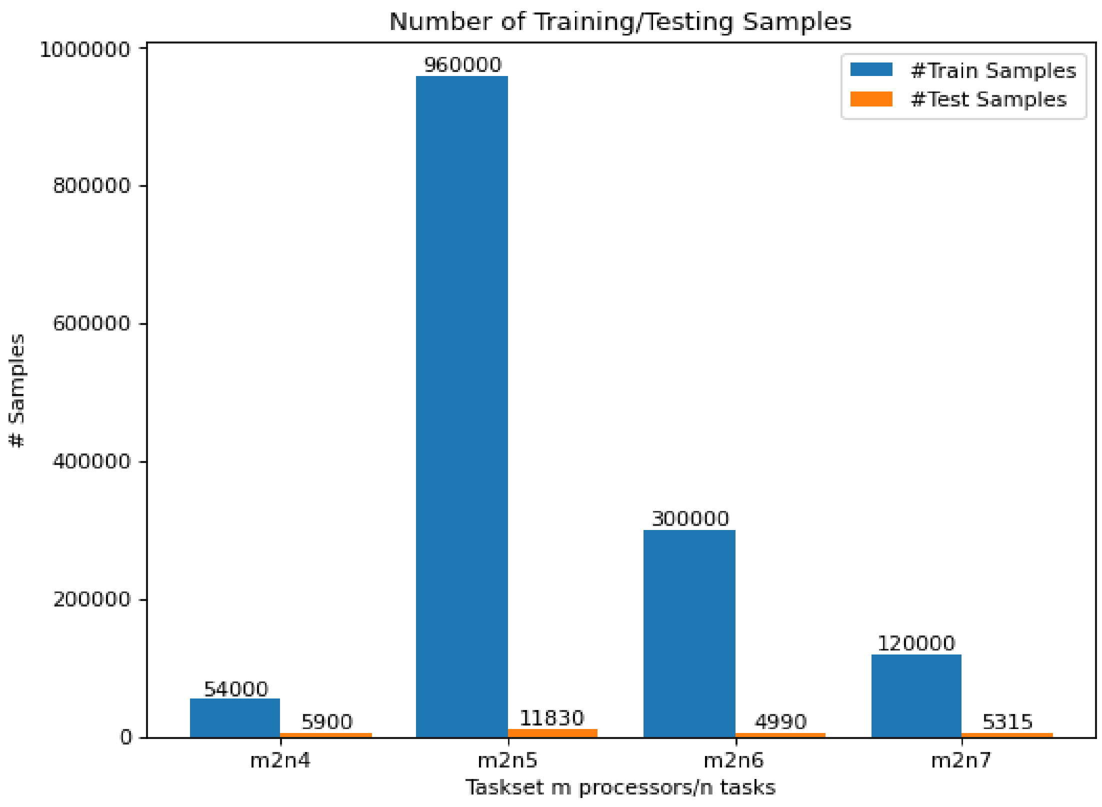
```
Building PAL model...
Model: "model_89"
__________________________________________________________________
________________________________
Layer (type)                    Output Shape         Param #     C
onnected to
==================================================================
================================
main_input (InputLayer)         [(None, 7, 2)]       0

__________________________________________________________________
________________________________
encoder (LSTM)                  [(None, 7, 512), (No 1054720     m
ain_input[0][0]
__________________________________________________________________
________________________________
decoder (PointerLSTM)           (None, 7, None)      2624000     e
ncoder[0][0]
                                                                 e
ncoder[0][1]
                                                                 e
ncoder[0][2]
==================================================================
================================
Total params: 3,678,720
Trainable params: 3,678,720
Non-trainable params: 0
__________________________________________________________________
________________________________
None
```

In [91]:

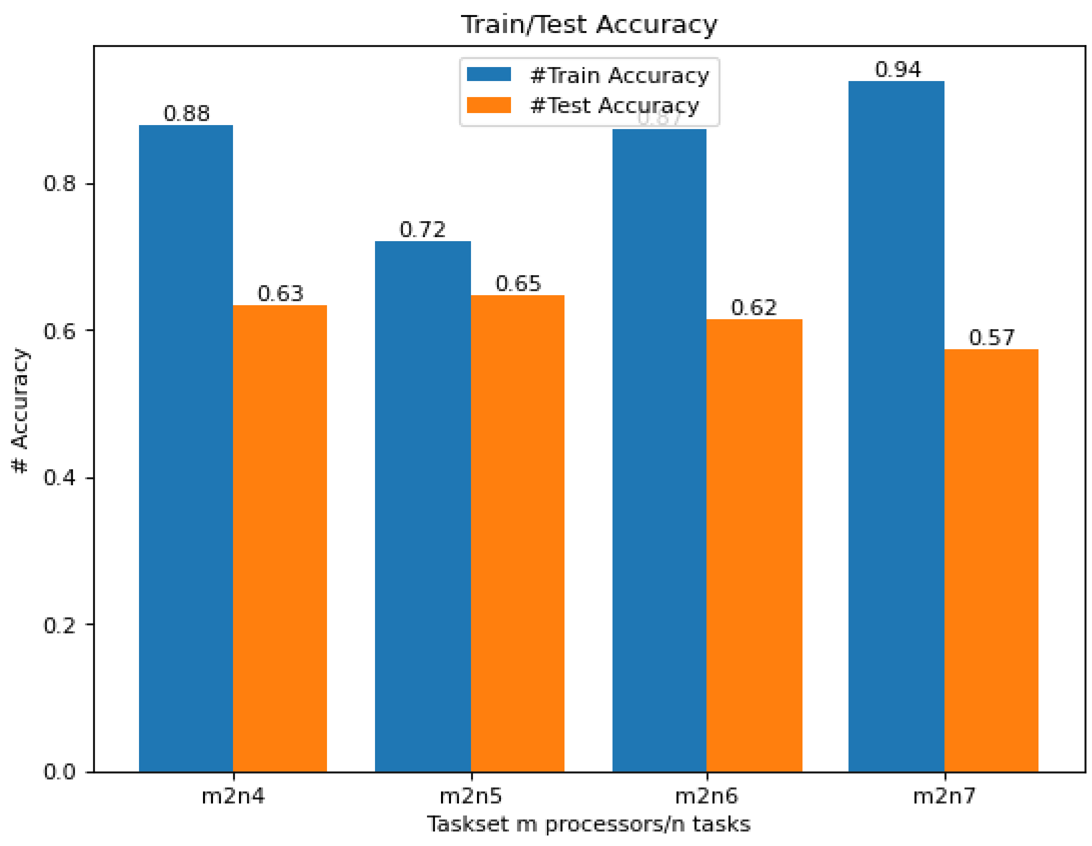
```
print("Train acc:", train_accs)
print("Test acc:", test_accs)
num_X_samples = [ len(Xs[i-4]) for i in [4,5,6,7]]
num_X_test_samples = [ len(X_tests[i-4]) for i in [4,5,6,7]]

print("num_X_samples: ", num_X_samples)
print("num_X_test_samples: ", num_X_test_samples)
print("num_Y_test_hat_samples:", num_Y_test_hat_samples)
```

```
Train acc: [0.879462962962963, 0.7210958333333334, 0.87485, 0.940
1]
Test acc: [0.6340677966101695, 0.6483516483516484, 0.6154308617234
469, 0.5747883349012229]
num_X_samples:  [54000, 960000, 300000, 120000]
num_X_test_samples:  [5900, 11830, 4990, 5315]
num_Y_test_hat_samples: [3741, 7670, 3071, 3055]
```

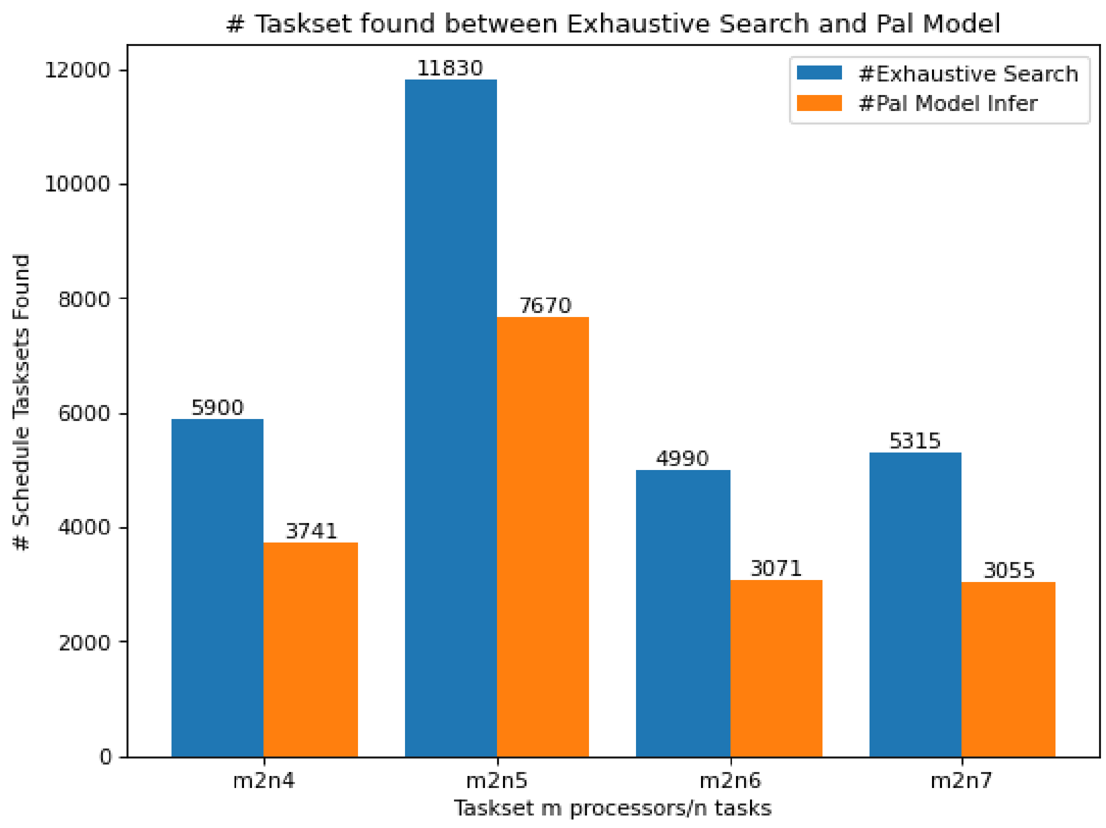
In [119]:
```python
figure(figsize=(8, 6), dpi=80)

X_label = ["m{}n{}".format(2,n) for n in [4,5,6,7]]

x_axis = np.arange(len(X_label))

bar1 = plt.bar(x_axis - 0.2, num_X_samples, width=0.4,  label = '#
Train Samples')
bar2 = plt.bar(x_axis + 0.2, num_X_test_samples, width=0.4, label
= '#Test Samples')

for rect in [*bar1 , *bar2]:
    height = rect.get_height()
    plt.text(rect.get_x() + rect.get_width()/2.0, height, '%d' % i
nt(height), ha='center', va='bottom')

plt.xticks(np.arange(len(X_label)), X_label)
#plt.ticklabel_format(axis="x", style="sci", scilimits=(0,10))
plt.ticklabel_format(axis="y", useOffset=False, style='plain')
plt.xlabel("Taskset m processors/n tasks")
plt.ylabel("# Samples")
plt.title("Number of Training/Testing Samples")
plt.legend()
plt.show()
```



In [122]:
```
figure(figsize=(8, 6), dpi=80)

bar1 = plt.bar(x_axis - 0.2, train_accs, width=0.4,  label = '#Tra
in Accuracy')
bar2 = plt.bar(x_axis + 0.2, test_accs, width=0.4, label = '#Test
Accuracy')

for rect in [*bar1 , *bar2]:
    height = rect.get_height()
    plt.text(rect.get_x() + rect.get_width()/2.0, height, '%.2f' %
height, ha='center', va='bottom')


plt.xticks(np.arange(len(X_label)), X_label)
plt.xlabel("Taskset m processors/n tasks")
plt.ylabel("# Accuracy")
plt.title("Train/Test Accuracy")
plt.legend()
plt.show()
```



In [123]:
```
figure(figsize=(8, 6), dpi=80)


bar1=plt.bar(x_axis - 0.2, num_X_test_samples, width=0.4,  label =
'#Exhaustive Search')
bar2=plt.bar(x_axis + 0.2, num_Y_test_hat_samples, width=0.4, labe
l = '#Pal Model Infer')
for rect in [*bar1 , *bar2]:
    height = rect.get_height()
    plt.text(rect.get_x() + rect.get_width()/2.0, height, '%d' % h
eight, ha='center', va='bottom')

plt.xticks(np.arange(len(X_label)), X_label)
plt.xlabel("Taskset m processors/n tasks")
plt.ylabel("# Schedule Tasksets Found")
plt.title("# Taskset found between Exhaustive Search and Pal Mode
l")
plt.legend()
plt.show()
```


# Taskset found between Exhaustive Search and Pal Model
#Exhaustive Search
#Pal Model Infer
# Schedule Tasksets Found
m2n4
m2n5
m2n6
m2n7
Taskset m processors/n tasks