In [1]:
```
import matplotlib.pyplot as plt
import numpy as np
import os
```

In [2]:
```
import tensorflow as tf

def eval_plot(file):
    return get_section_results(file, 'Eval_AverageReturn')

def get_section_results(file, s):
    eval_returns = []
    for e in tf.train.summary_iterator(file):
        for v in e.summary.value:
            if v.tag == s:
                eval_returns.append(v.simple_value)
    return eval_returns
```

```
/home/kevin/miniconda3/envs/cs285/lib/python3.6/site-packages/tensorflow/python
/framework/dtypes.py:523: FutureWarning: Passing (type, 1) or '1type' as a syno
nym of type is deprecated; in a future version of numpy, it will be understood
as (type, (1,)) / '(1,)type'.
  _np_qint8 = np.dtype([("qint8", np.int8, 1)])
/home/kevin/miniconda3/envs/cs285/lib/python3.6/site-packages/tensorflow/python
/framework/dtypes.py:524: FutureWarning: Passing (type, 1) or '1type' as a syno
nym of type is deprecated; in a future version of numpy, it will be understood
as (type, (1,)) / '(1,)type'.
  _np_quint8 = np.dtype([("quint8", np.uint8, 1)])
/home/kevin/miniconda3/envs/cs285/lib/python3.6/site-packages/tensorflow/python
/framework/dtypes.py:525: FutureWarning: Passing (type, 1) or '1type' as a syno
nym of type is deprecated; in a future version of numpy, it will be understood
as (type, (1,)) / '(1,)type'.
  _np_qint16 = np.dtype([("qint16", np.int16, 1)])
/home/kevin/miniconda3/envs/cs285/lib/python3.6/site-packages/tensorflow/python
/framework/dtypes.py:526: FutureWarning: Passing (type, 1) or '1type' as a syno
nym of type is deprecated; in a future version of numpy, it will be understood
as (type, (1,)) / '(1,)type'.
  _np_quint16 = np.dtype([("quint16", np.uint16, 1)])
/home/kevin/miniconda3/envs/cs285/lib/python3.6/site-packages/tensorflow/python
/framework/dtypes.py:527: FutureWarning: Passing (type, 1) or '1type' as a syno
nym of type is deprecated; in a future version of numpy, it will be understood
as (type, (1,)) / '(1,)type'.
  _np_qint32 = np.dtype([("qint32", np.int32, 1)])
/home/kevin/miniconda3/envs/cs285/lib/python3.6/site-packages/tensorflow/python
/framework/dtypes.py:532: FutureWarning: Passing (type, 1) or '1type' as a syno
nym of type is deprecated; in a future version of numpy, it will be understood
as (type, (1,)) / '(1,)type'.
  np_resource = np.dtype([("resource", np.ubyte, 1)])
```

In [23]:
```
def for_section (question):
    experiments = os.listdir('data')
    rv = {}
    for exp in experiments:
        if exp[:len(question)] == question:
            exp_fn = 'data/' + os.path.join (exp, os.listdir('data/' + exp)[0])
            print (exp)
            eval_avg_return = get_section_results (exp_fn, 'Eval_AverageReturn
')
            eval_std_return = get_section_results (exp_fn, 'Eval_StdReturn')
            rv[exp] = (eval_avg_return, eval_std_return)
    return rv
```

In [24]:
```
def plot_section (exp_dict, s, title, s_pass=False): # plot
    plt.title(title)
    plt.xlabel('iterations')
    plt.ylabel('mean eval return')
    for key in exp_dict.keys():
        if key[3:5] == s or s_pass: # 'sb' or 'lb'
            plt.plot (exp_dict[key][0], label=key)
    plt.legend()
    plt.show()
```

In [25]:
```
def plot_single (exp, title):
    plt.title(title)
    plt.xlabel('iterations')
    plt.ylabel('mean eval return')
    plt.plot (exp)
    plt.show()
```

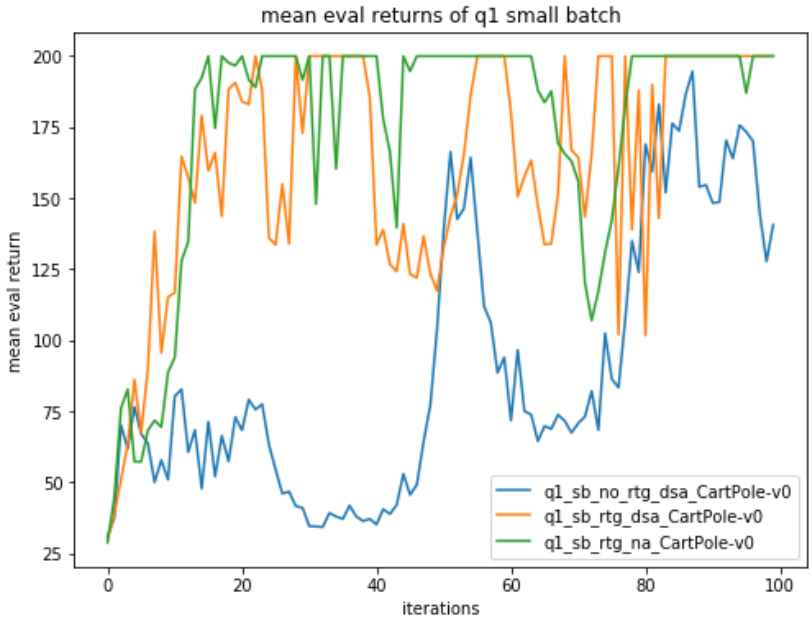
In [26]:
```
plt.rcParams['figure.figsize'] = 8, 6
```

q1

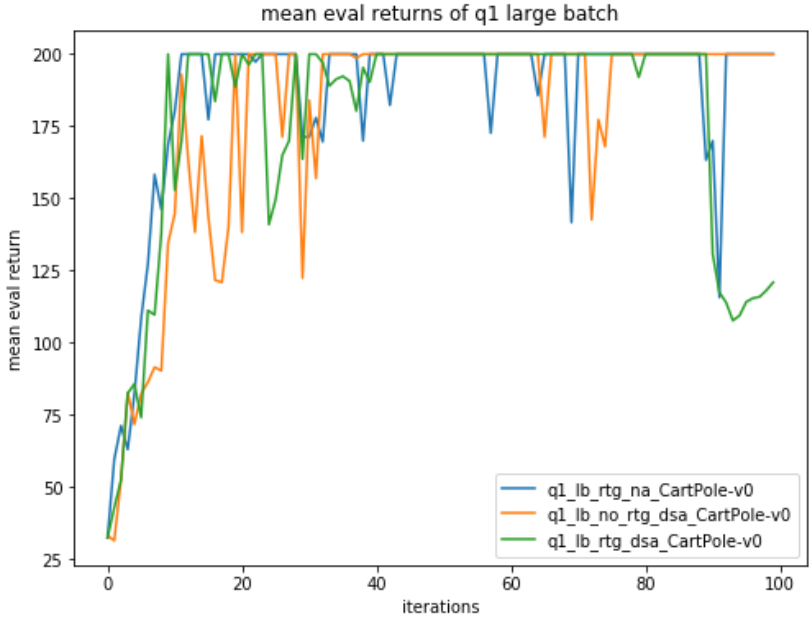
In [27]:
```
rv = for_section ('q1')
```

```
q1_sb_no_rtg_dsa_CartPole-v0
q1_lb_rtg_na_CartPole-v0
q1_sb_rtg_dsa_CartPole-v0
q1_lb_no_rtg_dsa_CartPole-v0
q1_sb_rtg_na_CartPole-v0
q1_lb_rtg_dsa_CartPole-v0
```

In [28]:
```
plot_section (rv, 'sb', 'mean eval returns of q1 small batch')
```



In [29]:
```
plot_section (rv, 'lb', 'mean eval returns of q1 large batch')
```



–Which value estimator has better performance without advantage-standardization: the trajectory-centric one, or the one using reward-to-go?

The reward-to-go value estimator did much better

–Did advantage standardization help?

Advantage standardization did not speed up the time to reach the convergence value, but helped the mean eval returns stay more consistent.

–Did the batch size make an impact?

The larger batch size greatly increased the rate of convergence and the consistency at convergence

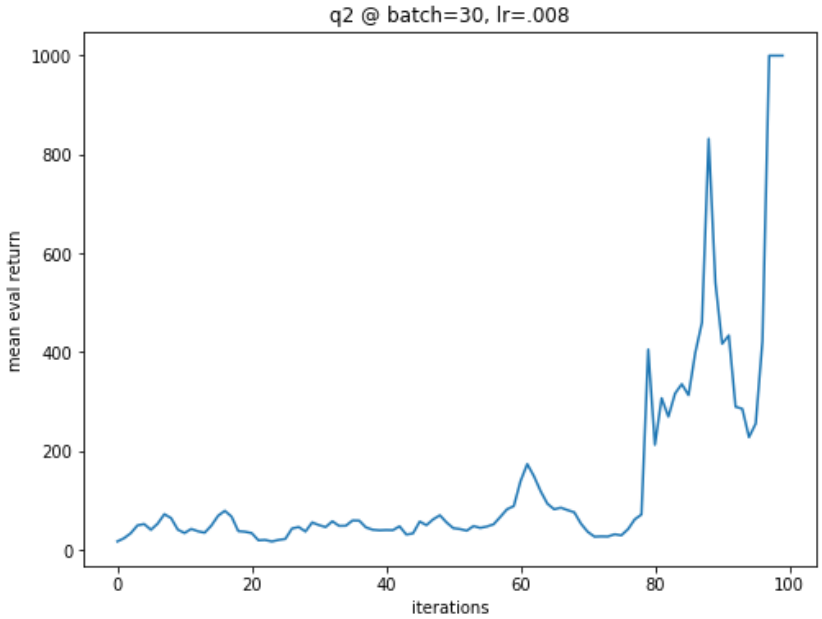
q2

python cs285/scripts/run_hw2.py --env_name InvertedPendulum-v2 \ --ep_len 1000 --discount 0.9 -n 100 -l 2 -s 64 -b 70 -lr .009 -rtg \ --exp_name q2_b70_r.009

In [11]:
```
rv2 = for_section ('q2')
```

```
q2_b70_r.009_InvertedPendulum-v2_27-09-2020_22-46-26
q2_b70_r.009_InvertedPendulum-v2_27-09-2020_22-47-41
```

In [12]:
```
plot_single (rv2['q2_b70_r.009_InvertedPendulum-v2_27-09-2020_22-46-26'][0], 'q2 @ batch=30, lr=.008')
```

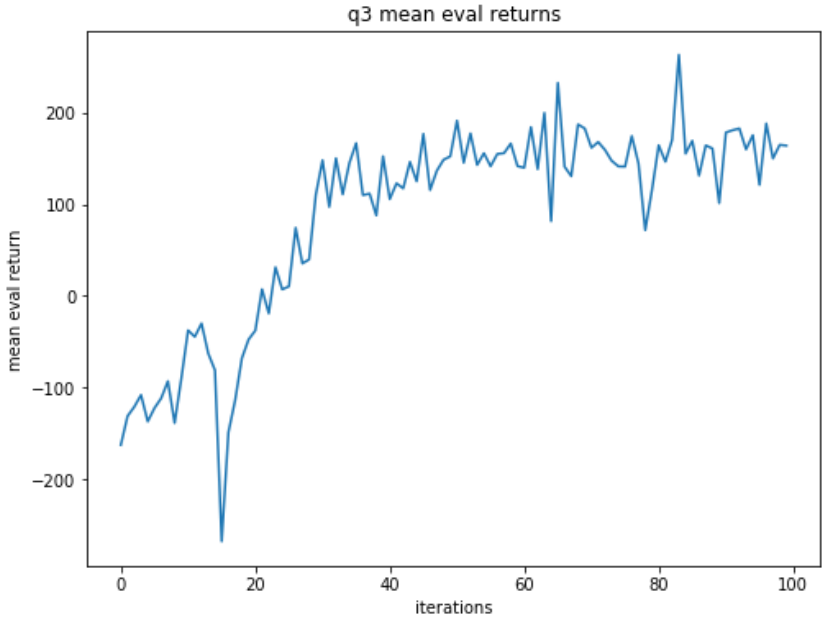


q3

In [13]:
```
rv3 = for_section ('q3')
```

```
q3_b40000_r0.005_LunarLanderContinuous-v2_27-09-2020_22-56-04
q3_b40000_r0.005_LunarLanderContinuous-v2_27-09-2020_22-54-38
q3_b40000_r0.005_LunarLanderContinuous-v2_27-09-2020_22-53-30
```

In [14]:
```
plot_single (rv3['q3_b40000_r0.005_LunarLanderContinuous-v2_27-09-2020_22-56-04
'][0], 'q3 mean eval returns')
```



q4

python cs285/scripts/run_hw2.py --env_name HalfCheetah-v2 --ep_len 150 \ --discount 0.95 -n 100 -l 2 -s 32 -b 30000 -lr 0.01 -rtg --nn_baseline \ --exp_name q4_search_b30000_lr0.01_rtg_nnbaseline

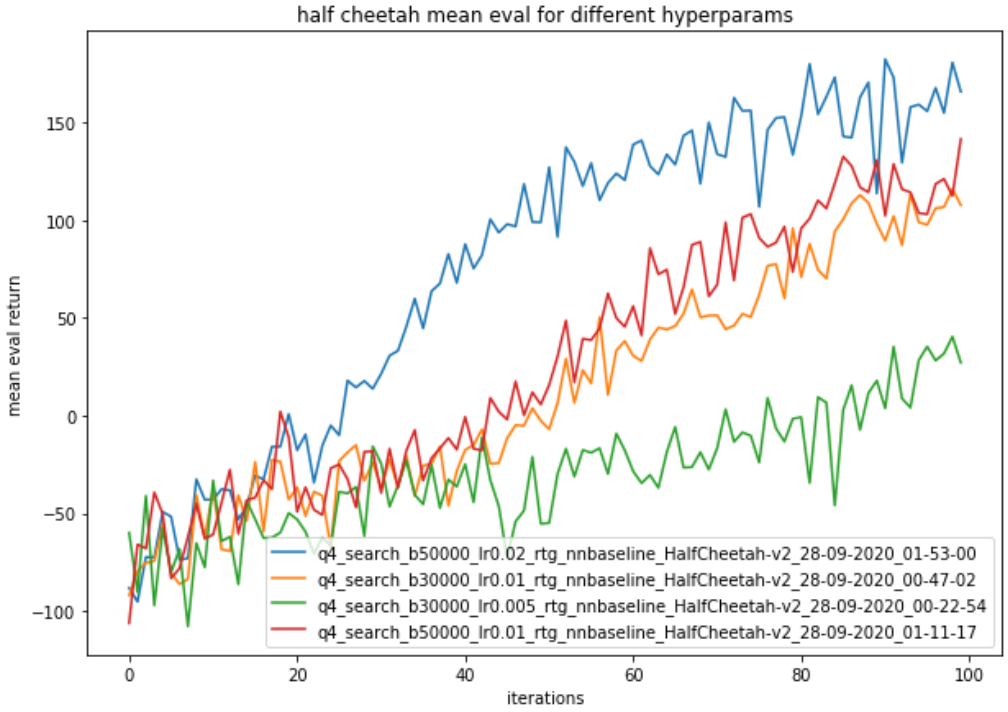
In [33]:
```
rv4 = for_section ('q4_s')
```

```
q4_search_b50000_lr0.02_rtg_nnbaseline_HalfCheetah-v2_28-09-2020_01-53-00
q4_search_b30000_lr0.01_rtg_nnbaseline_HalfCheetah-v2_28-09-2020_00-47-02
q4_search_b30000_lr0.005_rtg_nnbaseline_HalfCheetah-v2_28-09-2020_00-22-54
q4_search_b50000_lr0.01_rtg_nnbaseline_HalfCheetah-v2_28-09-2020_01-11-17
```

In [34]:
```
plt.rcParams['figure.figsize'] = 10, 7
```

q4a

In [35]:
```
plot_section (rv4, '', 'half cheetah mean eval for different hyperparams', True)
```



Increasing the learning rate and the batch size increased the mean eval return

q4b

python cs285/scripts/run_hw2.py --env_name HalfCheetah-v2 --ep_len 150 --discount 0.95 -n 100 -l 2 -s 32 -b 50000 -lr .02 --exp_name q4_b50000_r0.02

python cs285/scripts/run_hw2.py --env_name HalfCheetah-v2 --ep_len 150 --discount 0.95 -n 100 -l 2 -s 32 -b 50000 -lr .02 -rtg --exp_name q4_b50000_r0.02_rtg

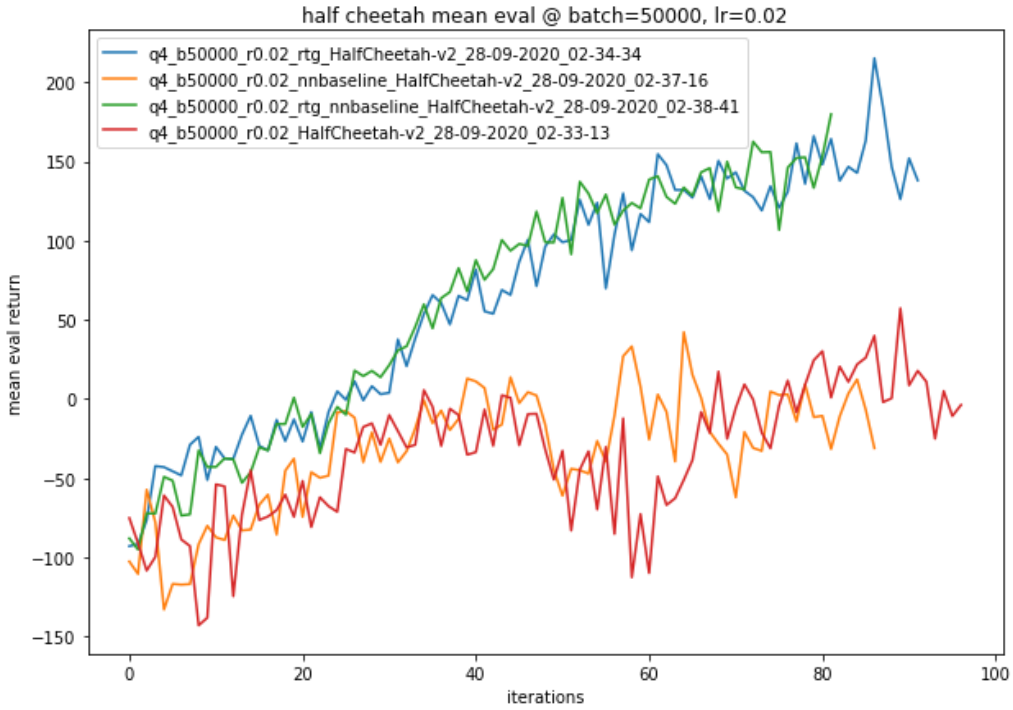
python cs285/scripts/run_hw2.py --env_name HalfCheetah-v2 --ep_len 150 --discount 0.95 -n 100 -l 2 -s 32 -b 50000 -lr .02 --nn_baseline --exp_name q4_b50000_r0.02_nnbaseline

python cs285/scripts/run_hw2.py --env_name HalfCheetah-v2 --ep_len 150 --discount 0.95 -n 100 -l 2 -s 32 -b 50000 -lr .02 -rtg --nn_baseline --exp_name q4_b50000_r0.02_rtg_nnbaseline

In [36]:
```
rv4b = for_section ('q4_b')
```

```
q4_b50000_r0.02_rtg_HalfCheetah-v2_28-09-2020_02-34-34
q4_b50000_r0.02_nnbaseline_HalfCheetah-v2_28-09-2020_02-37-16
q4_b50000_r0.02_rtg_nnbaseline_HalfCheetah-v2_28-09-2020_02-38-41
q4_b50000_r0.02_HalfCheetah-v2_28-09-2020_02-33-13
```

In [38]:
```
plot_section (rv4b, '', 'half cheetah mean eval @ batch=50000, lr=0.02', True)
```



In [ ]:
```
```