1.daphne

```
In [2]:
                    from daphne import daphne
                    import os, json
                    import numpy as np
                    import torch
                    from torch import tensor
                    import pandas as pd
                    import matplotlib.pyplot as plt
  In [3]:
                    def ast helper(fname, directory):
                            sugared fname = '../prob prog/hw/hw6/CS532-HW6/{}/{}'.format(directory,fname)
                            desugared ast json fname = '/Users/gw/repos/prob prog/' + sugared fname.replace('.daphne','.json')
                            if os.path.isfile(desugared ast json fname):
                                    with open (desugared ast json fname) as f:
                                            ast = json.load(f)
                                     #note: the sugared path that goes into daphne desugar should be with respect to the daphne path!
                                    ast = daphne(['desugar-hoppl-cps', '-i', sugared fname])
                                    with open(desugared ast json fname, 'w') as f:
                                            json.dump(ast, f)
                            return ast
                    fname = '{}.daphne'.format(i)
                    exp = ast helper(fname, directory='programs')
                    %cat programs/1.daphne
                    (defn until-success [p n]
                         (if (sample (flip p))
                             (until-success p (+ n 1))))
                    (let [p 0.01]
                       (until-success p 0))
  In [8]:
                    import smc, evaluator
                    import importlib
                    importlib.reload(smc)
                   <module 'smc' from '/Users/gw/repos/prob prog/hw/hw6/CS532-HW6/smc.py'>
  Out[8]:
In [11]:
                    output = lambda x: x
                    evaluator.evaluate(exp, env=None)('addr start', output)
                   (<function primitives.push addr(alpha, value, k)>,
Out[11]:
                     ['addr start', '0', <evaluator.Procedure at 0x135e73640>],
                     { 'type': 'proc'})
In [14]:
                    n particles=3
                    logZ, particles = smc.SMC(n_particles, exp)
                    particles
                   In SMC step 0, Zs: []
                   [tensor(42), tensor(122), tensor(88)]
Out[14]:
                 Note that there are no observed in this program, and thus Z is undefined
In [17]:
                    particle counts = [1,10,100,1000,10000,100000]
                    fig, axes = plt.subplots(nrows=len(particle counts), figsize=(30,20))
                    plt.subplots adjust(left=None, bottom=None, right=None, top=None, wspace=None, hspace=0.5) # https://stackoveri
                    for idx, n particles in enumerate(particle counts):
                             logZ, particles = smc.SMC(n particles, exp)
                            samples array = np.array([sample.item() for sample in particles])
                            mean = samples array.mean()
                            var = samples array.var()
                            pd.Series(samples array).plot.hist(ax=axes[idx], bins=50, title='Program {} | {} } particles | mean {:1.3f}
                   In SMC step 0, Zs: []
                   In SMC step 0, Zs:
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                                                                                     Program 1.daphne | 1 particles | mean 23.000 | var / std 0.000e+00 / 0.000e+00 | Evidence: logZ undefined / Z undefined
                      0.8
                     £ 0.6
                    nbed 0.4
                      0.2
                      0.0
                                                                                     Program 1.daphne | 10 particles | mean 88.200 | var / std 3.567e+03 / 5.972e+01 | Evidence: logZ undefined / Z undefined
                      1.5
                     를 1.0
                                                                                    Program 1.daphne | 100 particles | mean 107.130 | var / std 1.017e+04 / 1.009e+02 | Evidence: logZ undefined / Z undefined
                                                                                    Program 1.daphne | 1000 particles | mean 95.830 | var / std 9.451e+03 / 9.722e+01 | Evidence: logZ undefined / Z undefined
                      100
                       75
                       50
                                                                                    Program\ 1. daphne\ |\ 10000\ particles\ |\ mean\ 99.998\ |\ var\ /\ std\ 9.705e+03\ /\ 9.851e+01\ |\ Evidence:\ logZ\ undefined\ /\ Z\ undefined
                    ₹ 1000
                                                                                   Program\ 1. daphne\ |\ 100000\ particles\ |\ mean\ 98.957\ |\ var\ /\ std\ 9.919e+03\ /\ 9.960e+01\ |\ Evidence:\ log Z\ undefined\ /\ Z\ undefine\ /\ Z\ undefine\ /\ Z\ undefine\ /\ Z\ undef
                  jp 10000
```