Homework 6

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November 15, 2021

Link to repo:

https://github.com/keviny2/CPSC532W-Assignments/tree/main/HOPPL/SMC

Code Snippets

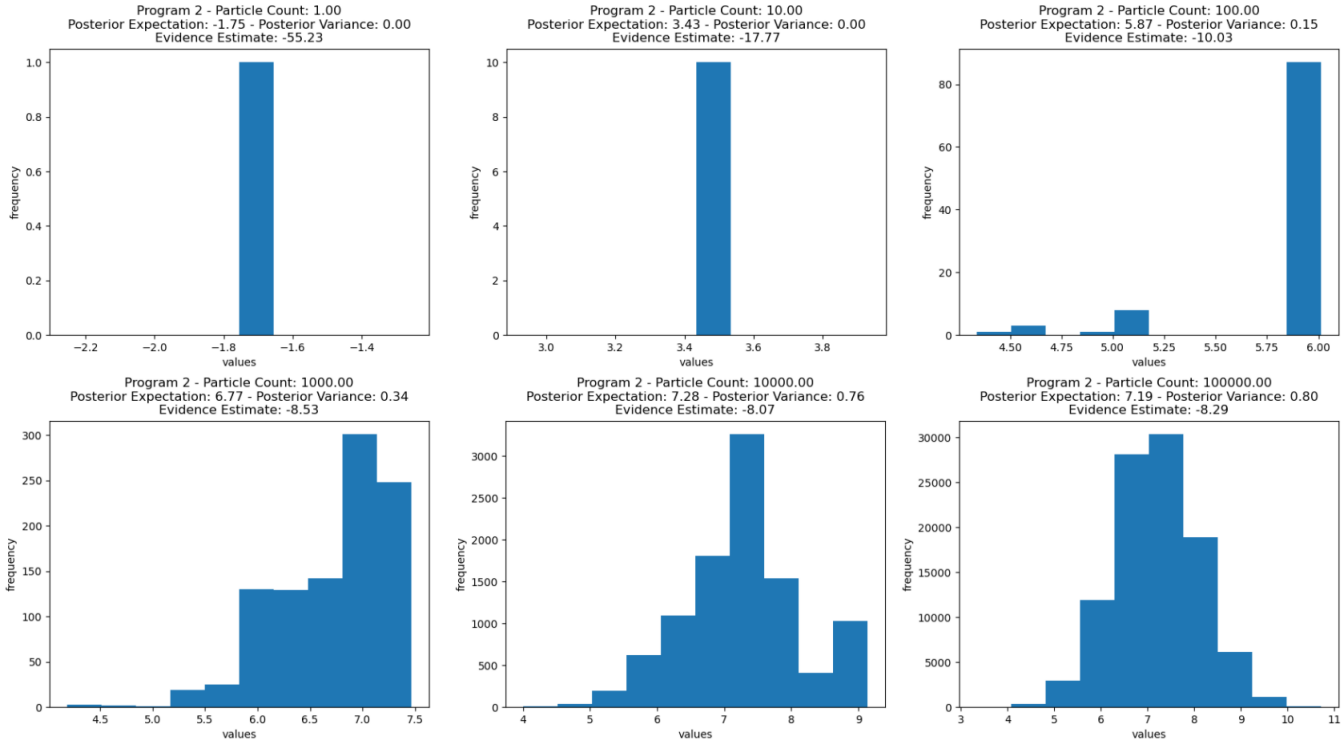
```python
def evaluate(exp, env=None):

    if env is None:
        env = standard_env()


    if type(exp) is list:
        op, *args = exp
        if op == 'sample':
            alpha = evaluate(args[0], env=env)
            d = evaluate(args[1], env=env)
            s = d.sample()
            k = evaluate(args[2], env=env)
            sigma = {'type': 'sample',
                     'addr': alpha
                     #TODO: put any other stuff you need here
                     }
            return k, [s], sigma
        elif op == 'observe':
            alpha = evaluate(args[0], env=env)
            d = evaluate(args[1], env=env)
            c = evaluate(args[2], env=env)
            k = evaluate(args[3], env=env)
            sigma = {'type': 'observe',
                     'logW': d.log_prob(c),
                     'addr': alpha
                     #TODO: put any other stuff you need here
                     }
            return k, [c], sigma
```

```python
            else:  # this is the observe case
                #TODO: check particle addresses, and get weights and continuations
                particles[i] = res

                weights[i] = res[2]['logW']

                if i == 0:
                    address = res[2]['addr']
                else:
                    assert address == res[2]['addr']
```

```python
def resample_particles(particles, log_weights):
    logZ = torch.log(torch.mean(torch.exp(log_weights)))

    weights = torch.exp(log_weights)
    weights /= torch.sum(weights)  # normalize

    new_particles_indices = torch.multinomial(weights, len(particles), True)
    new_particles = []
    for index in new_particles_indices:
        # BUG: maybe the particle addresses aren't being carried over???
        new_particles.append(particles[index])

    return logZ, new_particles
```

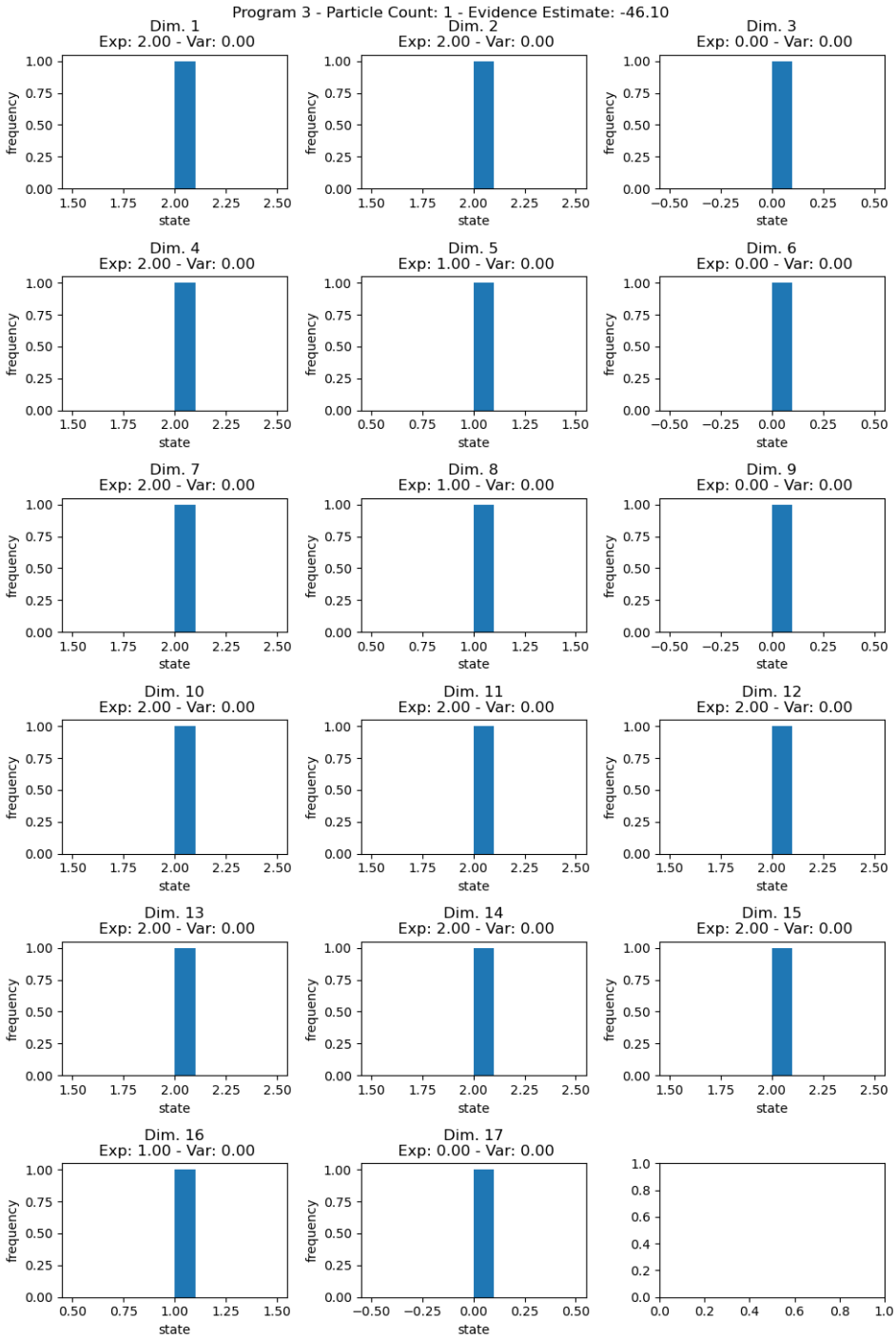
Program 2

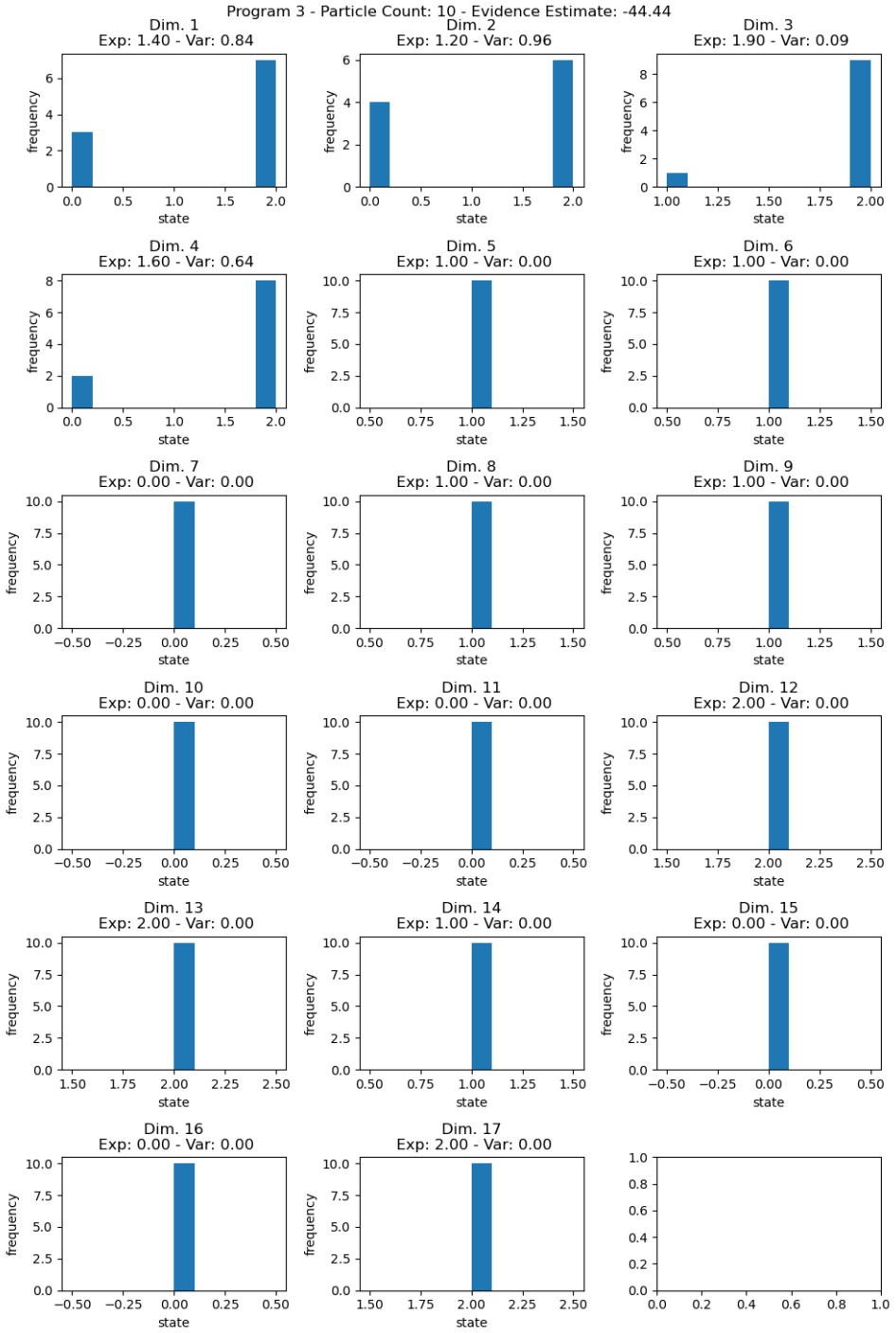
**Evidence Estimate in log space

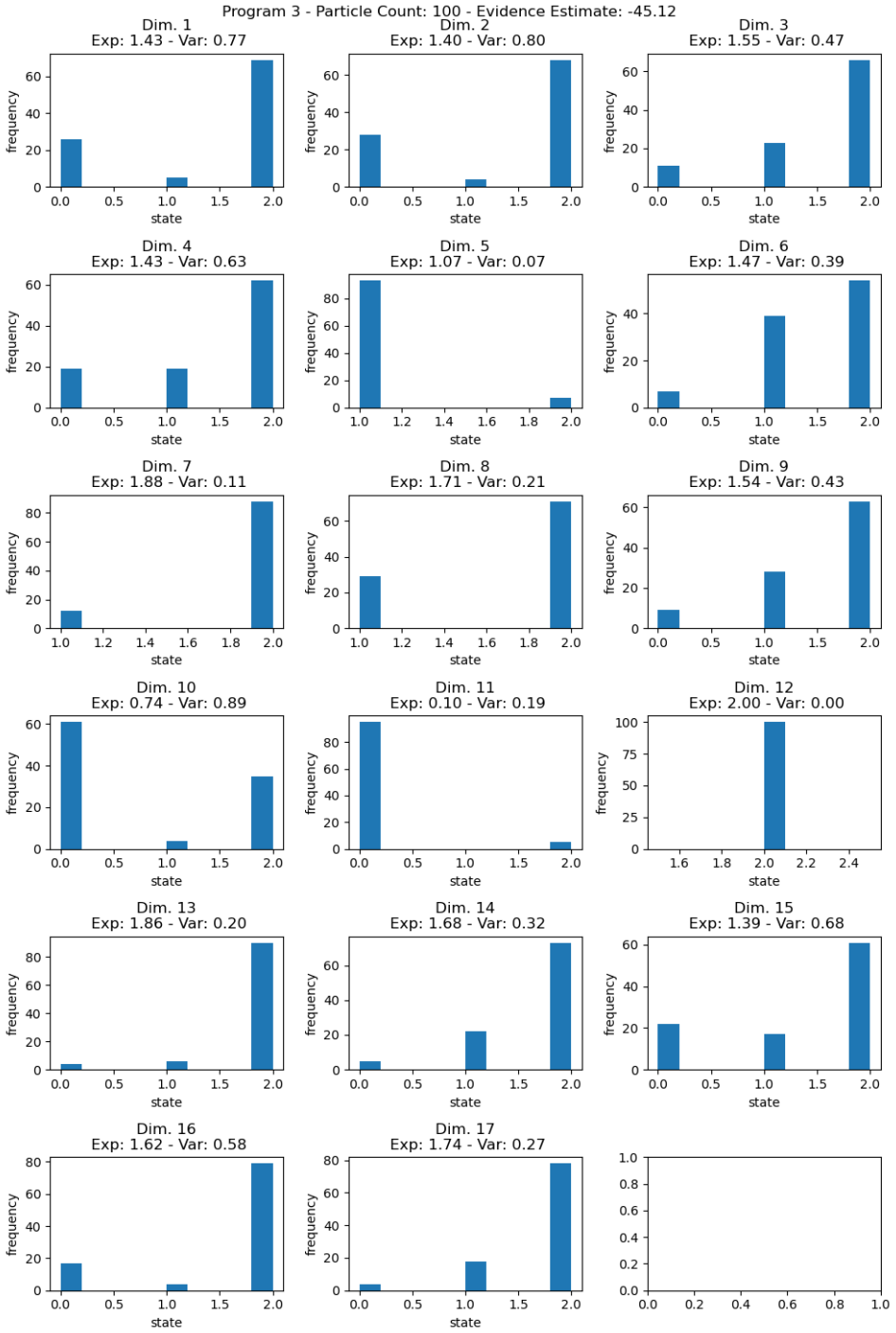


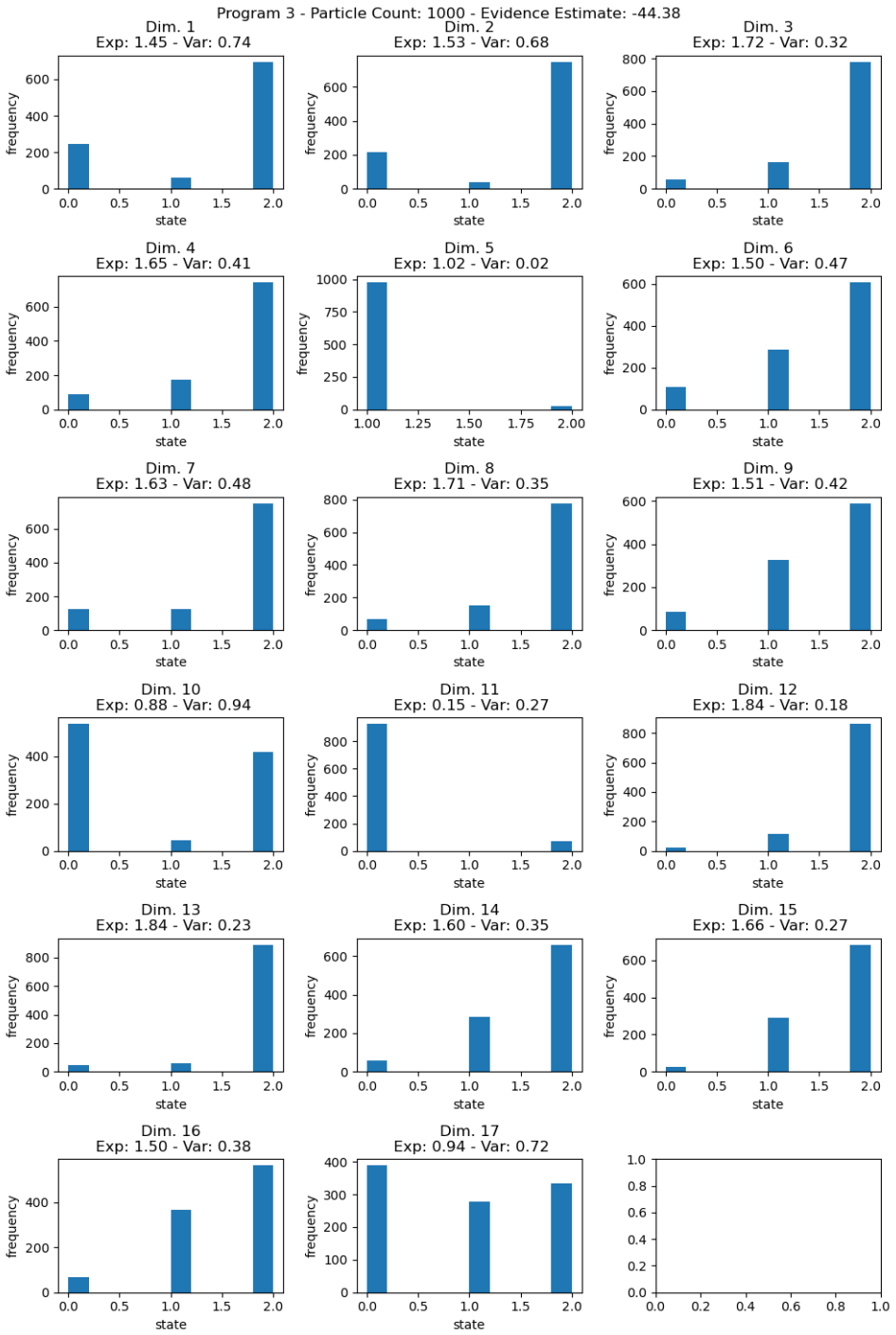
Program 3

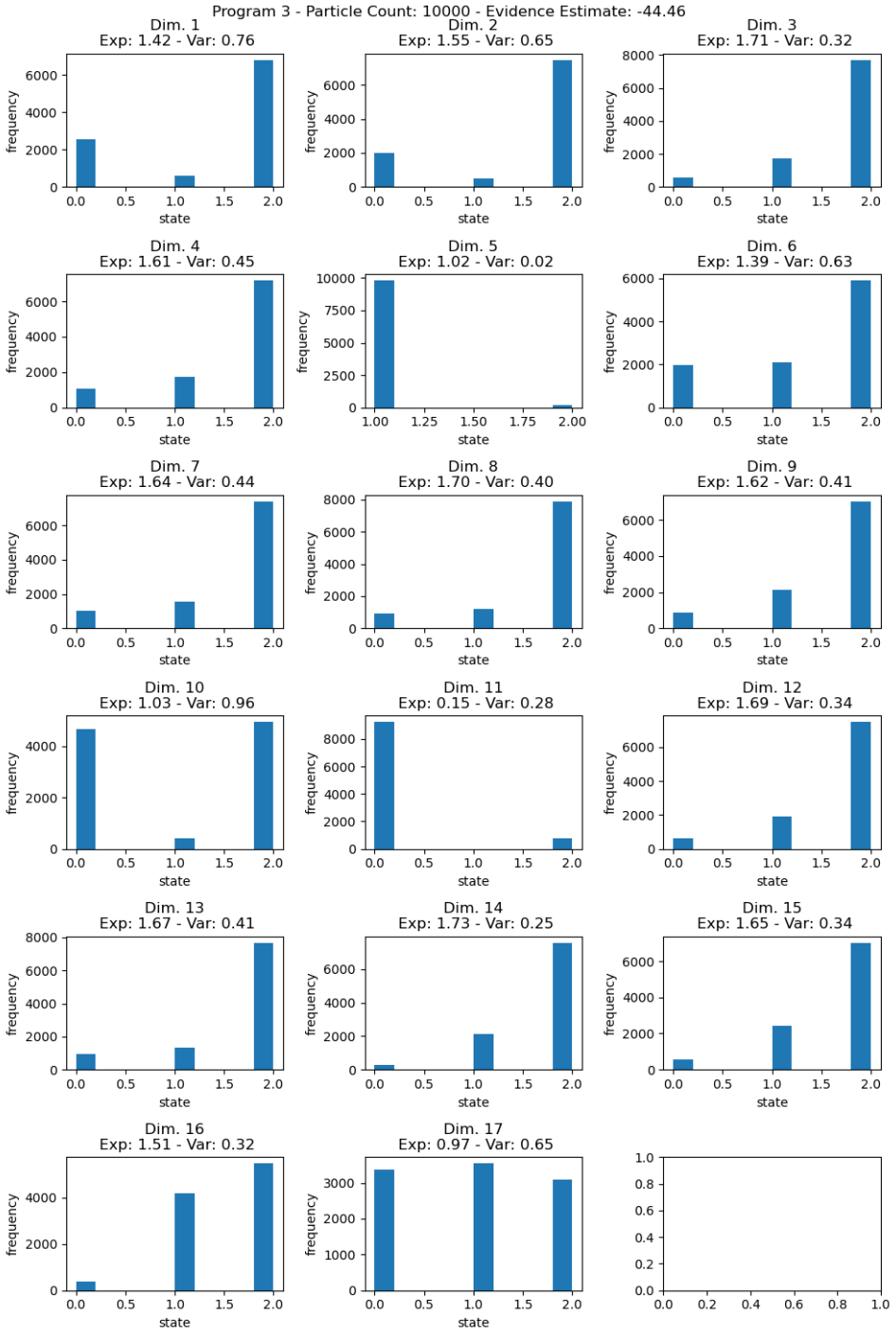
**Evidence Estimate in log space

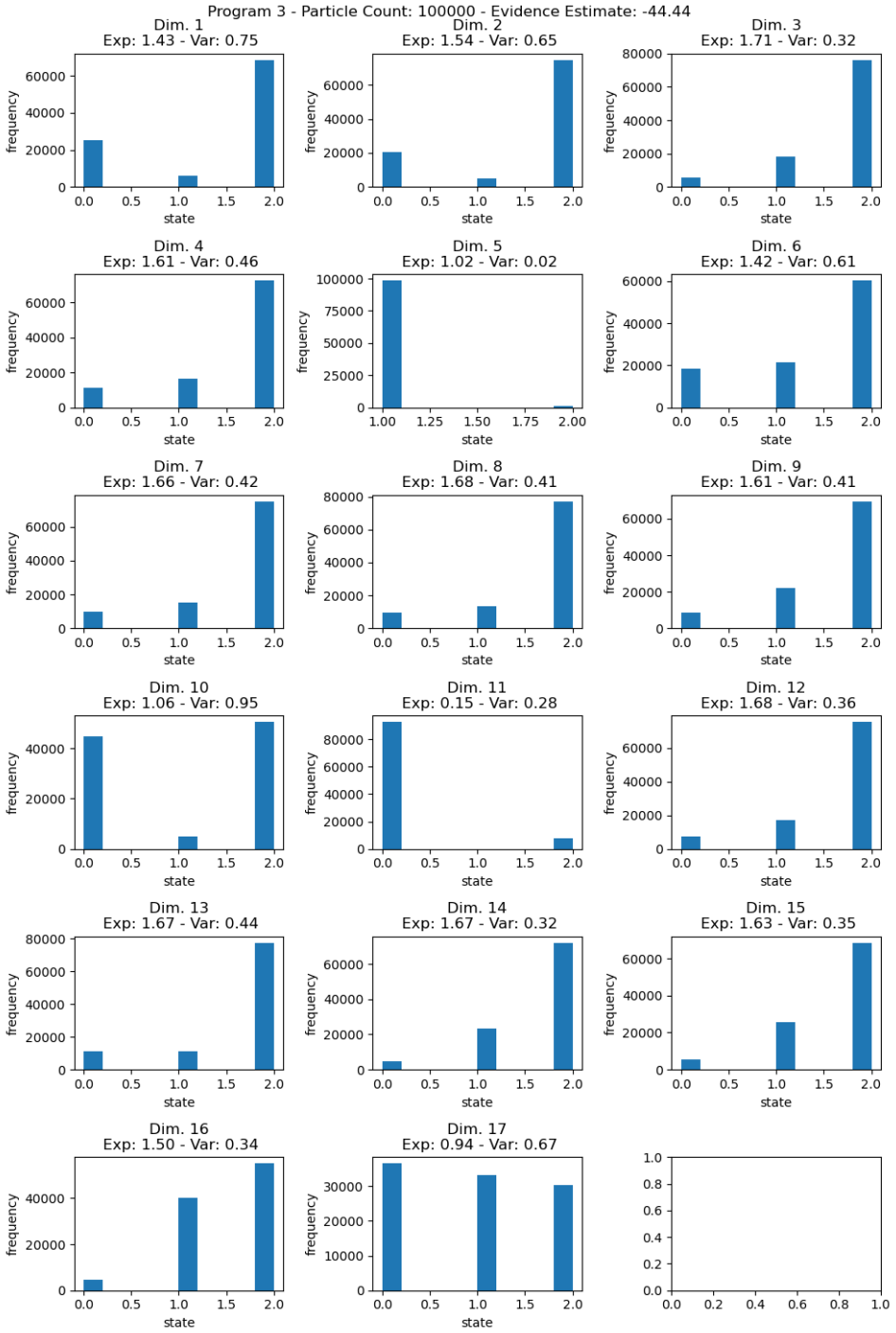



Program 3 - Particle Count: 10 - Evidence Estimate: -44.44
Dim. 1
Exp: 1.40 - Var: 0.84
Dim. 2
Exp: 1.20 - Var: 0.96
Dim. 3
Exp: 1.90 - Var: 0.09
Dim. 4
Exp: 1.60 - Var: 0.64
Dim. 5
Exp: 1.00 - Var: 0.00
Dim. 6
Exp: 1.00 - Var: 0.00
Dim. 7
Exp: 0.00 - Var: 0.00
Dim. 8
Exp: 1.00 - Var: 0.00
Dim. 9
Exp: 1.00 - Var: 0.00
Dim. 10
Exp: 0.00 - Var: 0.00
Dim. 11
Exp: 0.00 - Var: 0.00
Dim. 12
Exp: 2.00 - Var: 0.00
Dim. 13
Exp: 2.00 - Var: 0.00
Dim. 14
Exp: 1.00 - Var: 0.00
Dim. 15
Exp: 0.00 - Var: 0.00
Dim. 16
Exp: 0.00 - Var: 0.00
Dim. 17
Exp: 2.00 - Var: 0.00
frequency
state


Program 3 - Particle Count: 100 - Evidence Estimate: -45.12
Dim. 1
Exp: 1.43 - Var: 0.77
Dim. 2
Exp: 1.40 - Var: 0.80
Dim. 3
Exp: 1.55 - Var: 0.47
Dim. 4
Exp: 1.43 - Var: 0.63
Dim. 5
Exp: 1.07 - Var: 0.07
Dim. 6
Exp: 1.47 - Var: 0.39
Dim. 7
Exp: 1.88 - Var: 0.11
Dim. 8
Exp: 1.71 - Var: 0.21
Dim. 9
Exp: 1.54 - Var: 0.43
Dim. 10
Exp: 0.74 - Var: 0.89
Dim. 11
Exp: 0.10 - Var: 0.19
Dim. 12
Exp: 2.00 - Var: 0.00
Dim. 13
Exp: 1.86 - Var: 0.20
Dim. 14
Exp: 1.68 - Var: 0.32
Dim. 15
Exp: 1.39 - Var: 0.68
Dim. 16
Exp: 1.62 - Var: 0.58
Dim. 17
Exp: 1.74 - Var: 0.27
frequency
state


Program 3 - Particle Count: 1000 - Evidence Estimate: -44.38
Dim. 1
Exp: 1.45 - Var: 0.74
Dim. 2
Exp: 1.53 - Var: 0.68
Dim. 3
Exp: 1.72 - Var: 0.32
Dim. 4
Exp: 1.65 - Var: 0.41
Dim. 5
Exp: 1.02 - Var: 0.02
Dim. 6
Exp: 1.50 - Var: 0.47
Dim. 7
Exp: 1.63 - Var: 0.48
Dim. 8
Exp: 1.71 - Var: 0.35
Dim. 9
Exp: 1.51 - Var: 0.42
Dim. 10
Exp: 0.88 - Var: 0.94
Dim. 11
Exp: 0.15 - Var: 0.27
Dim. 12
Exp: 1.84 - Var: 0.18
Dim. 13
Exp: 1.84 - Var: 0.23
Dim. 14
Exp: 1.60 - Var: 0.35
Dim. 15
Exp: 1.66 - Var: 0.27
Dim. 16
Exp: 1.50 - Var: 0.38
Dim. 17
Exp: 0.94 - Var: 0.72
frequency
state


Program 3 - Particle Count: 10000 - Evidence Estimate: -44.46
Dim. 1
Exp: 1.42 - Var: 0.76
Dim. 2
Exp: 1.55 - Var: 0.65
Dim. 3
Exp: 1.71 - Var: 0.32
Dim. 4
Exp: 1.61 - Var: 0.45
Dim. 5
Exp: 1.02 - Var: 0.02
Dim. 6
Exp: 1.39 - Var: 0.63
Dim. 7
Exp: 1.64 - Var: 0.44
Dim. 8
Exp: 1.70 - Var: 0.40
Dim. 9
Exp: 1.62 - Var: 0.41
Dim. 10
Exp: 1.03 - Var: 0.96
Dim. 11
Exp: 0.15 - Var: 0.28
Dim. 12
Exp: 1.69 - Var: 0.34
Dim. 13
Exp: 1.67 - Var: 0.41
Dim. 14
Exp: 1.73 - Var: 0.25
Dim. 15
Exp: 1.65 - Var: 0.34
Dim. 16
Exp: 1.51 - Var: 0.32
Dim. 17
Exp: 0.97 - Var: 0.65
frequency
state


Program 3 - Particle Count: 100000 - Evidence Estimate: -44.44
Dim. 1
Exp: 1.43 - Var: 0.75
Dim. 2
Exp: 1.54 - Var: 0.65
Dim. 3
Exp: 1.71 - Var: 0.32
Dim. 4
Exp: 1.61 - Var: 0.46
Dim. 5
Exp: 1.02 - Var: 0.02
Dim. 6
Exp: 1.42 - Var: 0.61
Dim. 7
Exp: 1.66 - Var: 0.42
Dim. 8
Exp: 1.68 - Var: 0.41
Dim. 9
Exp: 1.61 - Var: 0.41
Dim. 10
Exp: 1.06 - Var: 0.95
Dim. 11
Exp: 0.15 - Var: 0.28
Dim. 12
Exp: 1.68 - Var: 0.36
Dim. 13
Exp: 1.67 - Var: 0.44
Dim. 14
Exp: 1.67 - Var: 0.32
Dim. 15
Exp: 1.63 - Var: 0.35
Dim. 16
Exp: 1.50 - Var: 0.34
Dim. 17
Exp: 0.94 - Var: 0.67
frequency
state

Program 4

**Evidence Estimate in log space