

PROGRAMMING ASSIGNMENT 2

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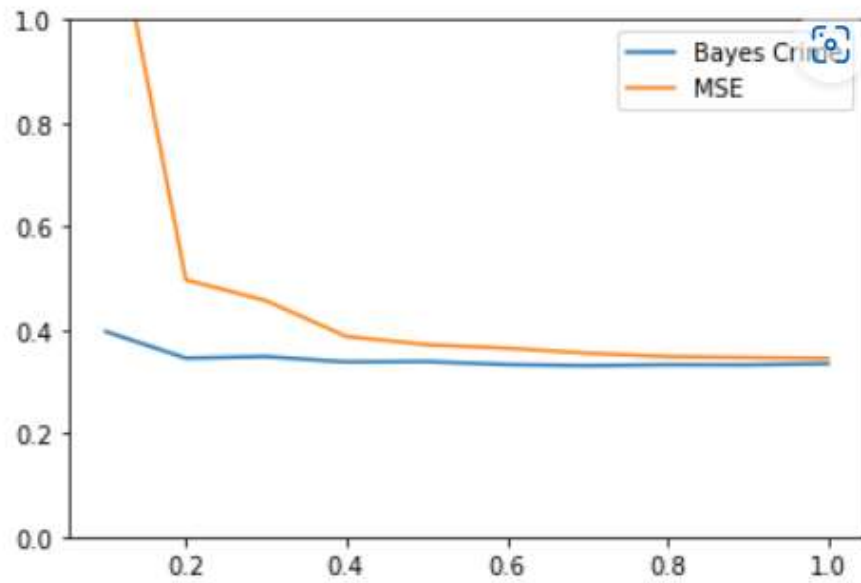
Task 1:

```
{'partition': 0.1, 'alpha': 188.13418564070818, 'beta': 3.0590610997375354, 'regularization': 61.50063026098103}
{'partition': 0.2, 'alpha': 284.7219942674846, 'beta': 2.964418873946527, 'regularization': 96.04647871116627}
{'partition': 0.3, 'alpha': 266.99009988195087, 'beta': 2.847152772909647, 'regularization': 93.77441998277473}
{'partition': 0.4, 'alpha': 280.4488295991778, 'beta': 2.8496845641386455, 'regularization': 98.41399049159224}
{'partition': 0.5, 'alpha': 284.08760024259936, 'beta': 2.9156222181703813, 'regularization': 97.4363545702676}
{'partition': 0.6, 'alpha': 263.4754615387708, 'beta': 2.962261804049953, 'regularization': 88.9440160820869}
{'partition': 0.7, 'alpha': 254.16163967645417, 'beta': 3.0875611127863833, 'regularization': 82.31793003996117}
{'partition': 0.8, 'alpha': 254.20674738385384, 'beta': 3.1241961399624962, 'regularization': 81.36708964338757}
{'partition': 0.9, 'alpha': 247.4375126121574, 'beta': 3.046255677039333, 'regularization': 81.22677110696198}
{'partition': 1.0, 'alpha': 239.71632213512905, 'beta': 3.0852982512664147, 'regularization': 77.69632061883588}
```

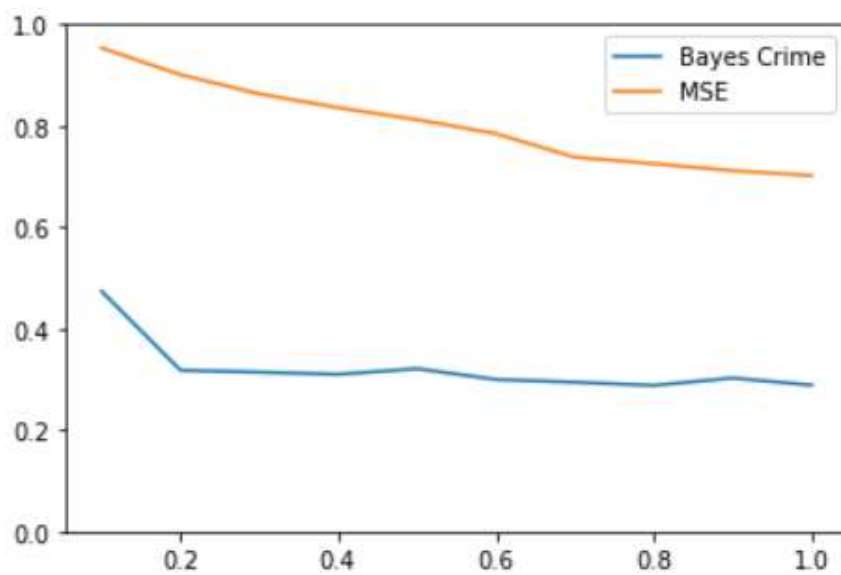
Values for crime dataset

```
{'partition': 0.1, 'alpha': (17.115748346919897-4.8112392413123525e-30j), 'beta': (55.43127666781543+4.35640031600882e-29j), 'regularization': (0.308774204308696-3.2946525412022132e-31j)}
{'partition': 0.2, 'alpha': 16.334287029416586, 'beta': 3.4586561427608227, 'regularization': 4.722726502779191}
{'partition': 0.3, 'alpha': 17.047085057337306, 'beta': 4.1144505963678375, 'regularization': 4.1432226874679605}
{'partition': 0.4, 'alpha': 18.406145860229955, 'beta': 4.974604278779374, 'regularization': 3.700022118090225}
{'partition': 0.5, 'alpha': 17.80860565102691, 'beta': 4.411526273698912, 'regularization': 4.0368354501706305}
{'partition': 0.6, 'alpha': 19.53644116765738, 'beta': 4.691276605105255, 'regularization': 4.1644189443864725}
{'partition': 0.7, 'alpha': 18.642552046513647, 'beta': 4.393500189872348, 'regularization': 4.243211844963025}
{'partition': 0.8, 'alpha': 19.27321350878941, 'beta': 4.549846965772047, 'regularization': 4.23601357447393}
{'partition': 0.9, 'alpha': 16.95077861294148, 'beta': 4.119603837235635, 'regularization': 4.114662303139301}
{'partition': 1.0, 'alpha': 20.412460531028803, 'beta': 4.041255751833772, 'regularization': 5.051019233753366}
```

Values for housing dataset

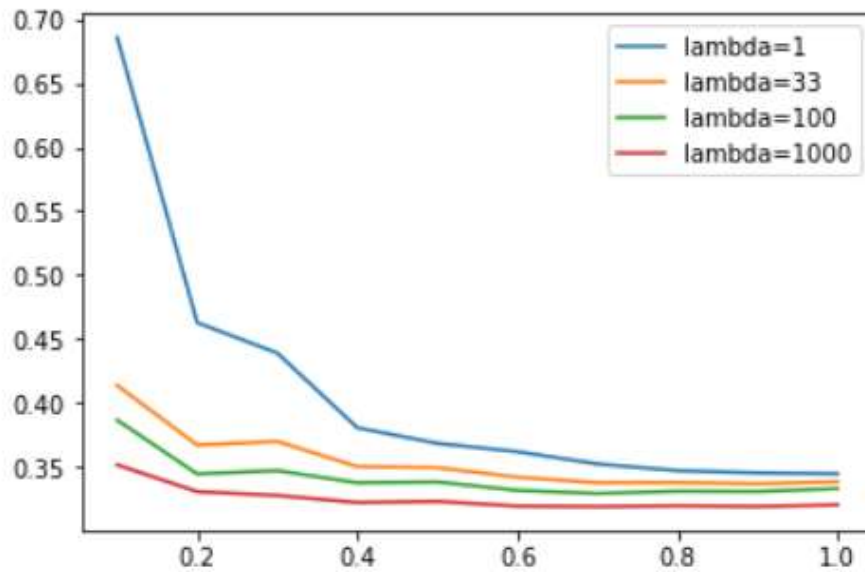


Graph for Crime dataset

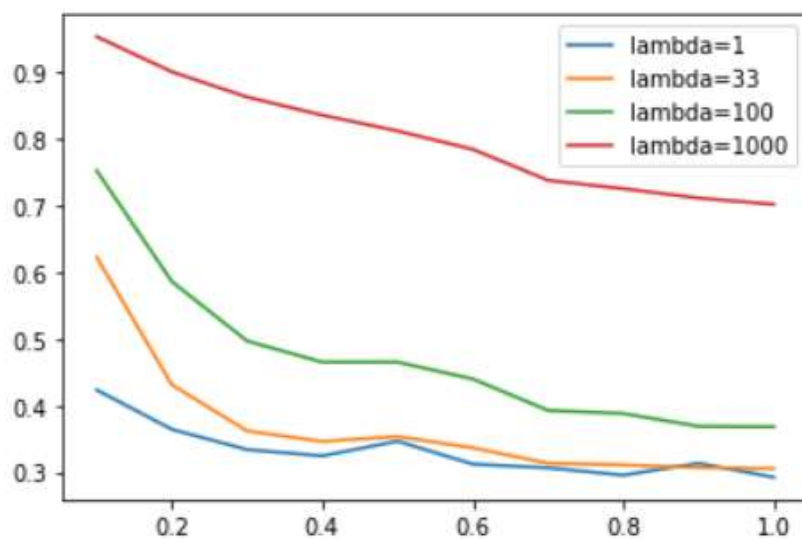


From the graph we can conclude that when size is less MSE is very high and decreases as the dataset size increases. Eventually both bayesian MSE and normal MSE converge together after a specific data size threshold

Graph for Housing dataset



Graph for crime dataset for different lamda values



Graph for housing dataset for different lamda values

We cant use universal value of lamda for different datasets because different datasets can be affected differently by the change in datasets.

Task 2:

logev_3

```
[(1, -3031.2969121330398),  
(2, -3028.564275831095),  
(3, -2695.224252770911),  
(4, -2701.4329184615654),  
(5, -2706.667939500311),  
(6, -2707.3946126834317),  
(7, -2721.462621288671),  
(8, -2732.579184186423),  
(9, -2746.881958887436),  
(10, (-2761.319226132034+0j))]
```

MSE_3

```
[(1, 39389142.58553826),  
(2, 39495762.45900575),  
(3, 148429.38836568058),  
(4, 179627.46131843395),  
(5, 186263.6807275151),  
(6, 211370.60715117436),  
(7, 184992.29642495257),  
(8, 196641.43358936673),  
(9, 546257.7759903334),  
(10, 579316.5958650279)]
```

Log evidence and MSE for f3

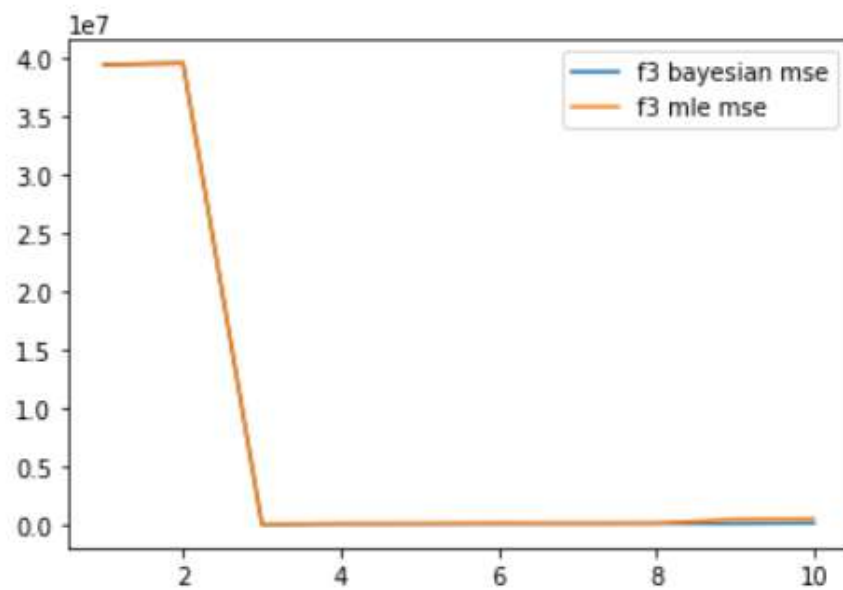
logev_5

```
[(1, -4360.422864141759),  
(2, -3912.9560540194047),  
(3, -3908.1614614004034),  
(4, -2714.974896657237),  
(5, -2721.7392525595783),  
(6, -2729.895548191721),  
(7, -2741.309541933108),  
(8, -2754.408590279996),  
(9, (-2769.3179042194065+0j)),  
(10, -2788.119185549046)]
```

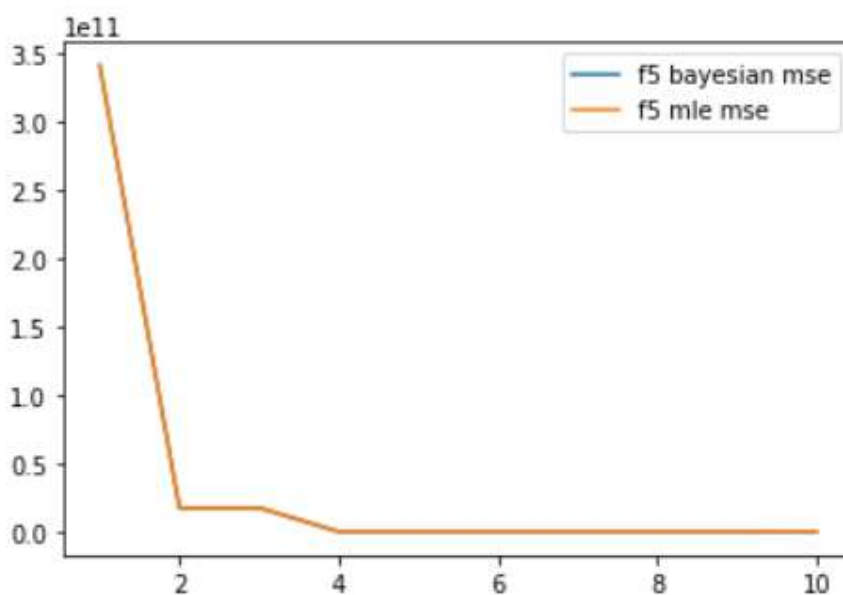
MSE_5

```
[(1, 341195638304.2565),  
(2, 17465602121.94851),  
(3, 17435655143.626442),  
(4, 61375.3499006928),  
(5, 79043.03733122443),  
(6, 92512.84710342463),  
(7, 90189.90562969688),  
(8, 126835.276487774),  
(9, 7703653.185180388),  
(10, 238757655.70912683)]
```

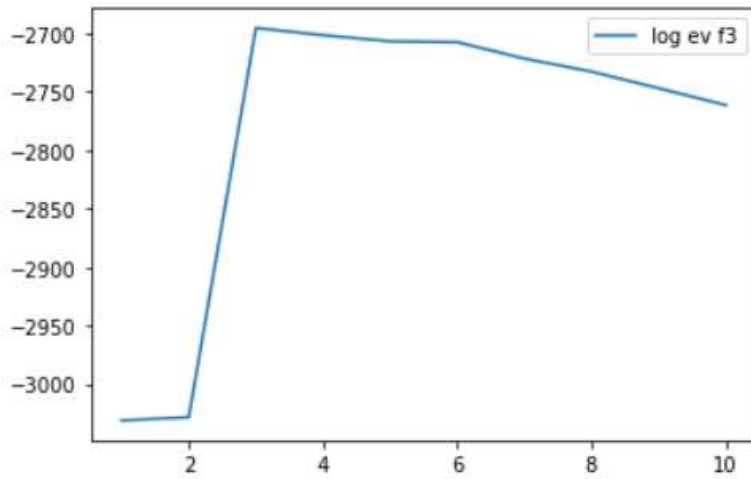
Log evidence and MSE for f5



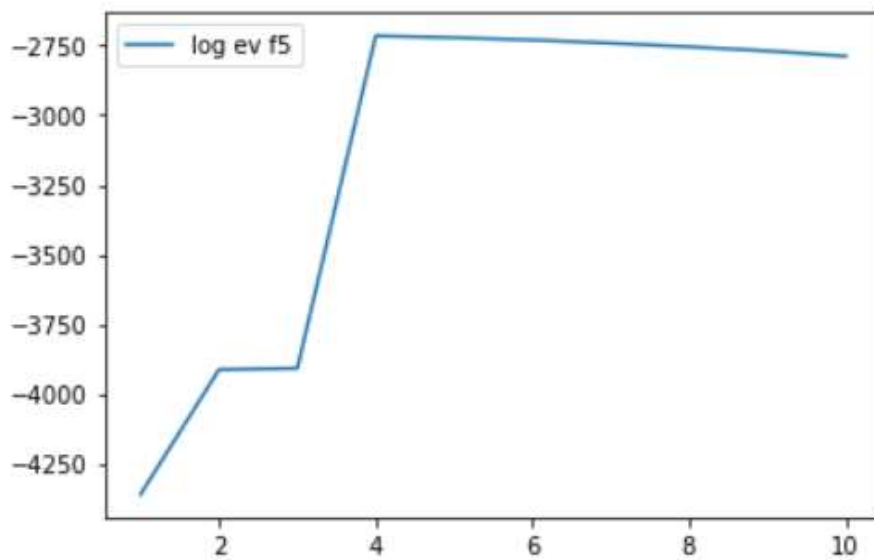
Graph for f3 bayesian and mle mse



Graph for f5 bayesian and mle mse



Graph for Log evidence of f3



Graph for log evidence of f5

The graph for regularized and non regularized are almost similar hence we can conclude that both predict similar values in this case

The evidence calculation is successful in selecting alpha, beta and the regularization