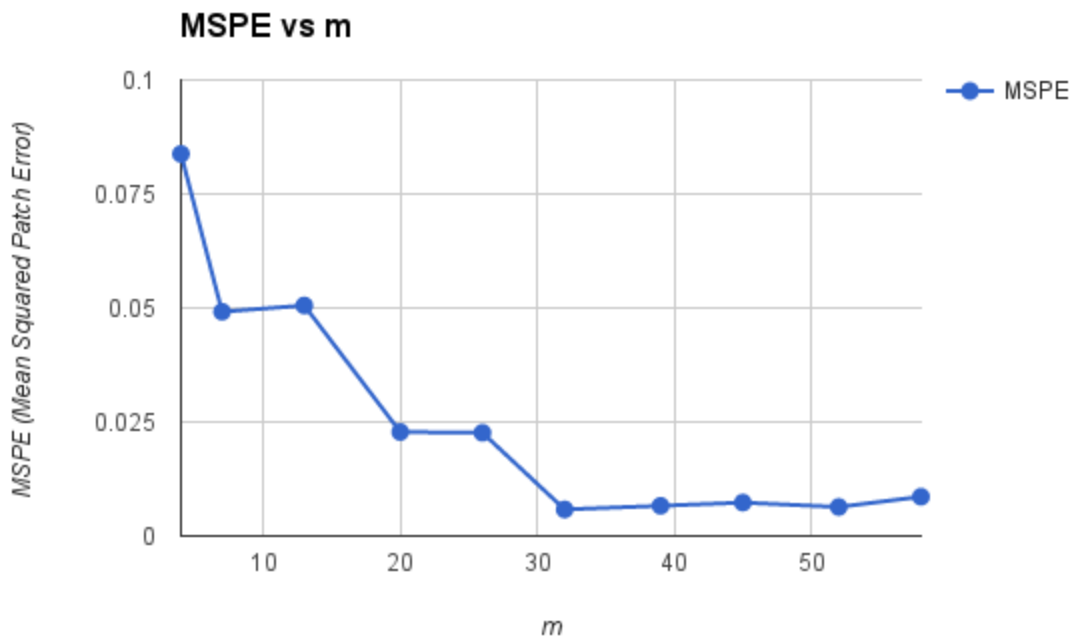# Assignment 5 Question 3 Report

- OMP with Gaussian Measurement Matrix

MSIE vs m

MSPE vs m
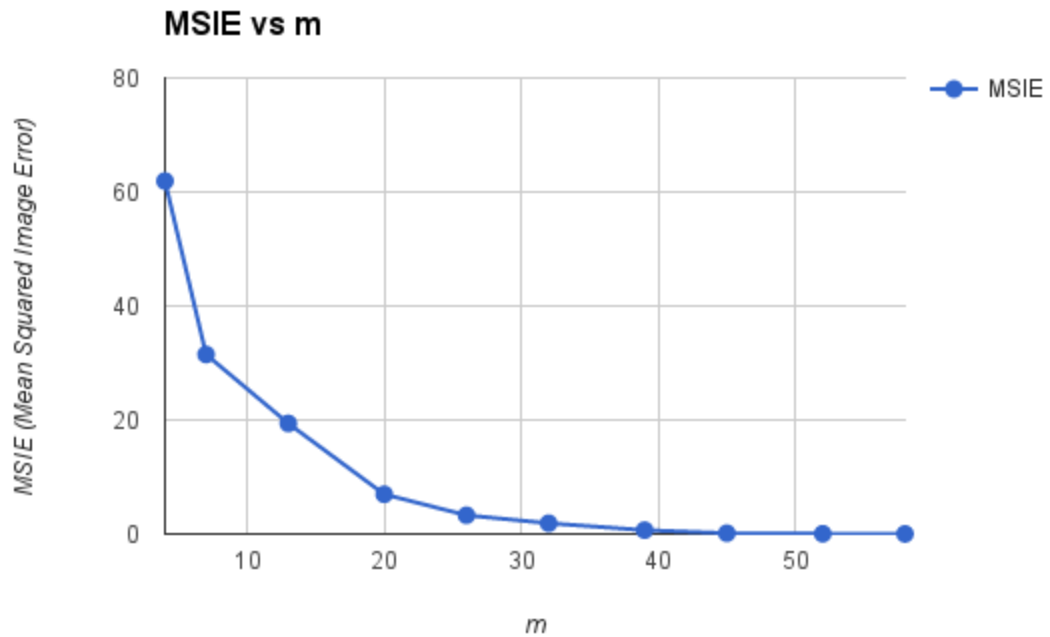
Both MSIE and MSPE decrease as m increases because the signal is better approximated in

the case of a larger m. We have to find the linear combination of atoms that represent the signal, if we take lesser components of the signal into consideration, the fit is not that good, as we keep on taking more components into consideration, the fit becomes better and better.

- Pseudo-inverse with Gaussian Matrix

MSIE vs m

MSPE vs m
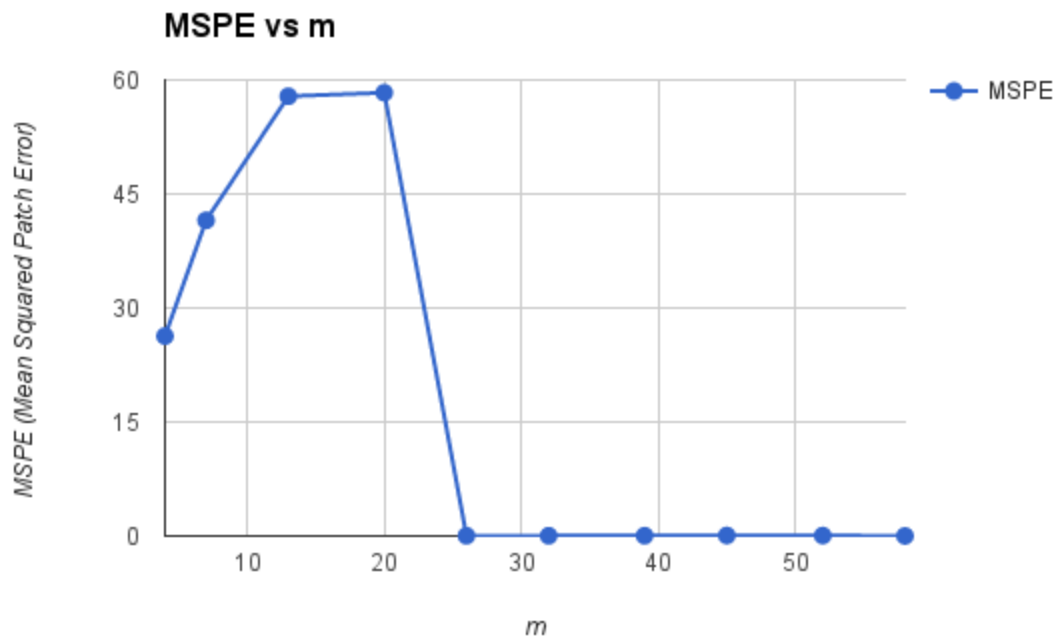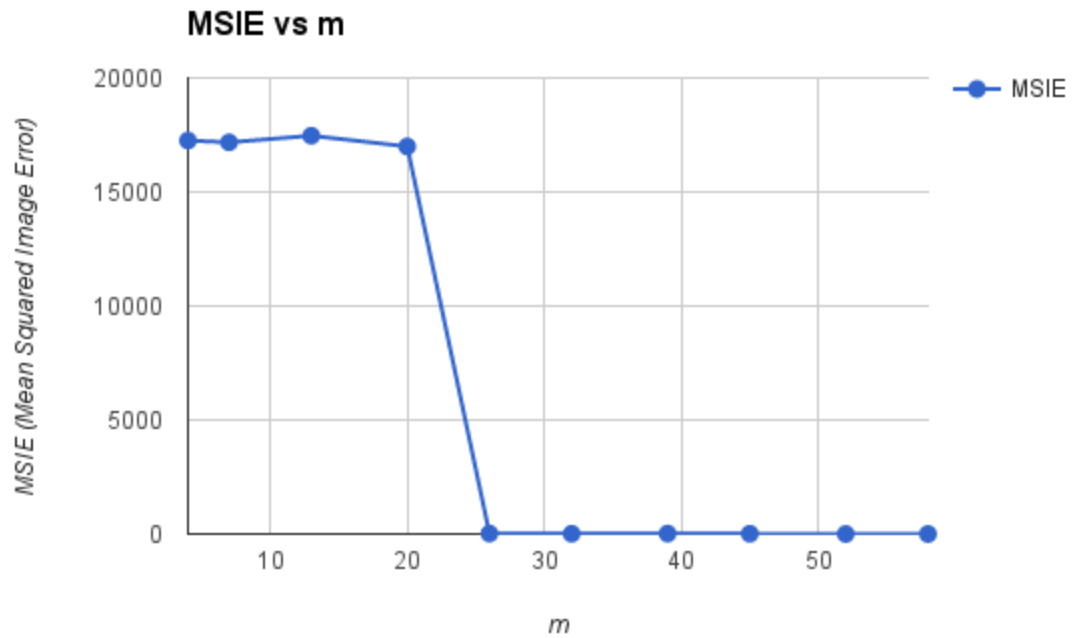
For m < 25, pseudo-inverse cannot be used to approximate the signal. Thus the values of MSIE and MSPE are very high in the beginning. The signal is sparse in the DCT domain and for m > 25, the sparsity can be modeled by pseudo-inverse and it can be used to approximate the signal.

OMP		Pseudo-inverse	
MSIE	MSPE	MSIE	MSPE
0.01656114245	0.008614404611	0.1615288792	0.007309035126
0.04034495517	0.006358502441	1.515472549	0.05362096634
0.1384367889	0.007324026299	10.72082275	0.06666853874
0.6725814594	0.00661989569	17.42813554	0.03696774823
1.886716967	0.005821187042	10.75180127	0.03200975756
3.283869448	0.02263340196	18.22958866	0.02875802391
6.962916586	0.02281100374	16997.07469	58.32466989
19.39831924	0.05055067299	17467.49013	57.86083417
31.49632471	0.04917725667	17177.27991	41.53159261
61.92192045	0.08378893238	17256.76362	26.30411123

OMP approximates the signal better than pseudo-inverse because it calculates the pseudo-inverse of the optimal m atoms from the dictionary and hence the values of MSIE and MSPE values of pseudo-inverse are higher than that of OMP.

- 2D DCT Measurement Matrix

MSIE vs m

MSPE vs m
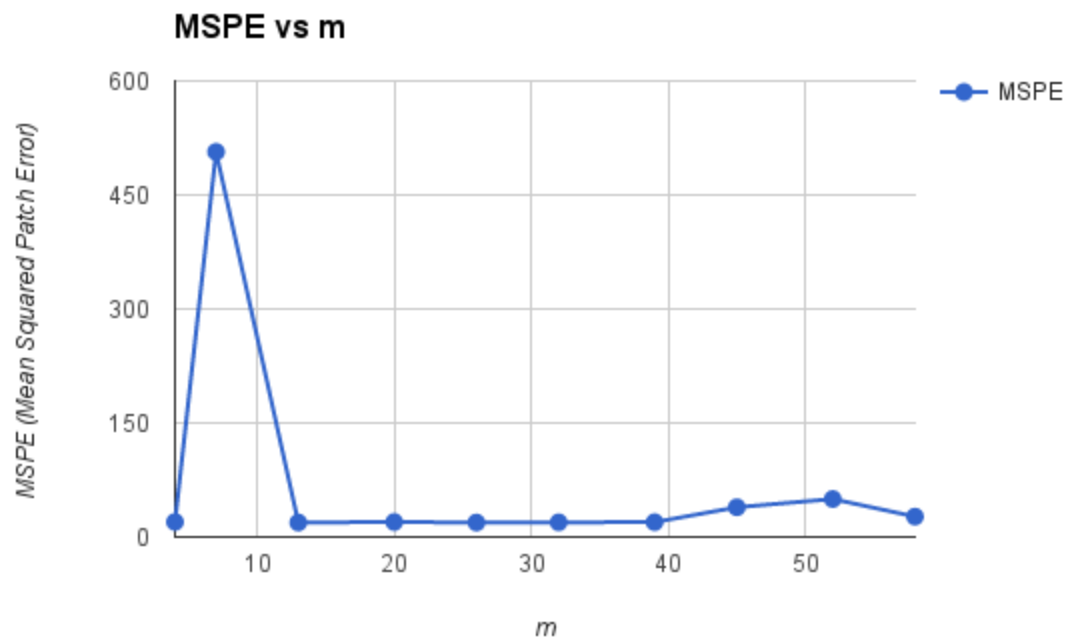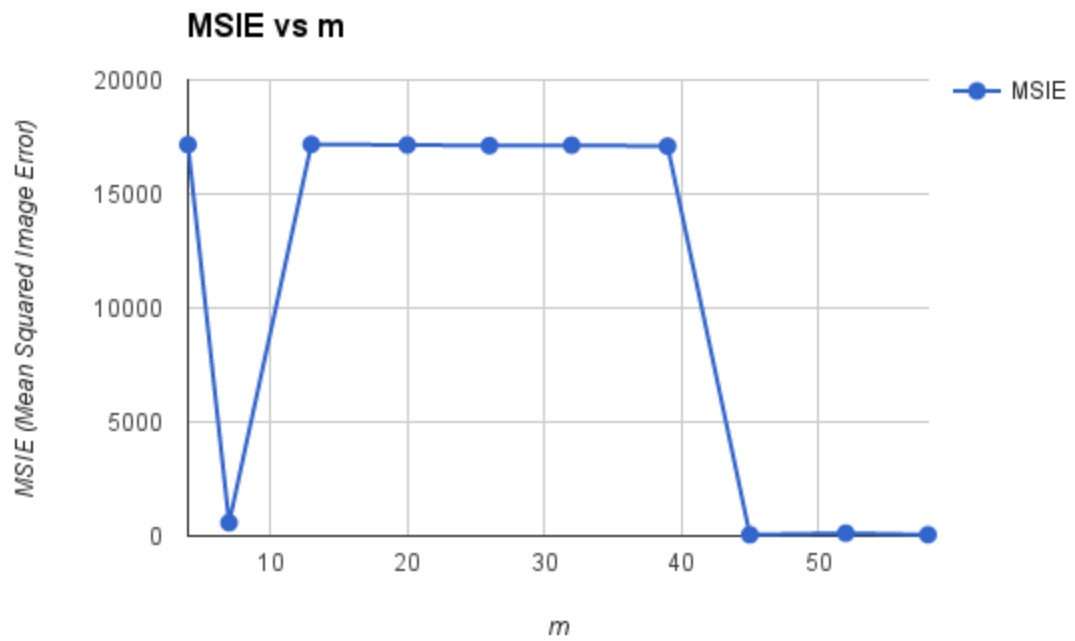
MSIE	MSPE
55.67774468	26.82886567
122.4462615	49.93894875
54.70799994	39.10400994
17097.98896	19.51164322
17140.1405	19.30467446
17120.41981	19.02928482
17150.78692	19.74328698
17175.2355	19.01719993
580.0032092	506.7843952
17163.11455	19.82474187

The values of MSIE and MSPE are high in this case because the DCT measurement matrix doesn't satisfy the incoherency assumption. In case of OMP with Gaussian distribution, the measurement matrix is incoherent with DCT basis and hence it can approximate the signal well which is not the case here.