

1.(a) regression, inference,  $n=500$ ,  $p=3$

(b) classification, prediction,  $n=20$ ,  $p=13$

(c) regression, prediction,  $n=52$ ,  $p=3$

2. ① 0.6

With shrinkage coefficient becoming bigger, the bias of  $\hat{\beta}$  becomes smaller and the variance of  $\hat{\beta}$  becomes bigger, so 0.6 is optimal value.

② 0.8. In bigger training set, the variance of  $\hat{\beta}$  becomes smaller, so the optimal shrinkage coefficient can be bigger than smaller training set

③ 0.9, for higher true  $\beta$  value, the variance of  $\hat{\beta}$  doesn't change, but bias becomes higher for same shrinkage coefficient. Thus, the optimal coefficient need to be higher.

3.