Assignment #9

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```
## Loading required package: stats4
## Loading required package: evd
## Warning: package 'evd' was built under R version 3.4.4
```

Problem 1

Part i

Part ii

Part iii

Part iv

Part v

Problem 2

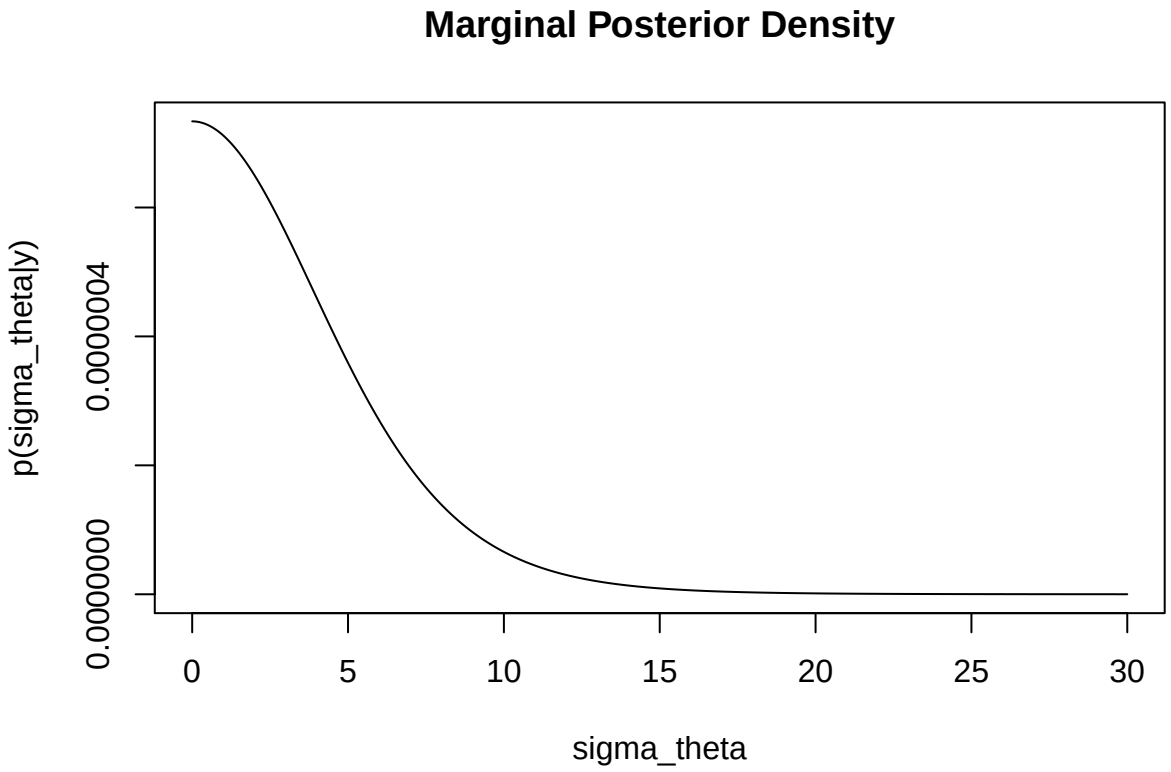
$[\bar{y}_{.j}|\theta_j, \sigma_j] \overset{indep}{\sim} N(\theta_j, \sigma_j^2), \qquad j = 1, ..., J$
$[\theta_j|\mu, \sigma_\theta] \overset{iid}{\sim} N(\mu, \sigma_\theta^2), \qquad j = 1, ..., J$
$p(\mu, \theta) = p(\mu)p(\theta), \qquad p(\mu) \propto 1, \qquad [\sigma_\theta] \sim Uniform(0, A), \qquad A = 100$

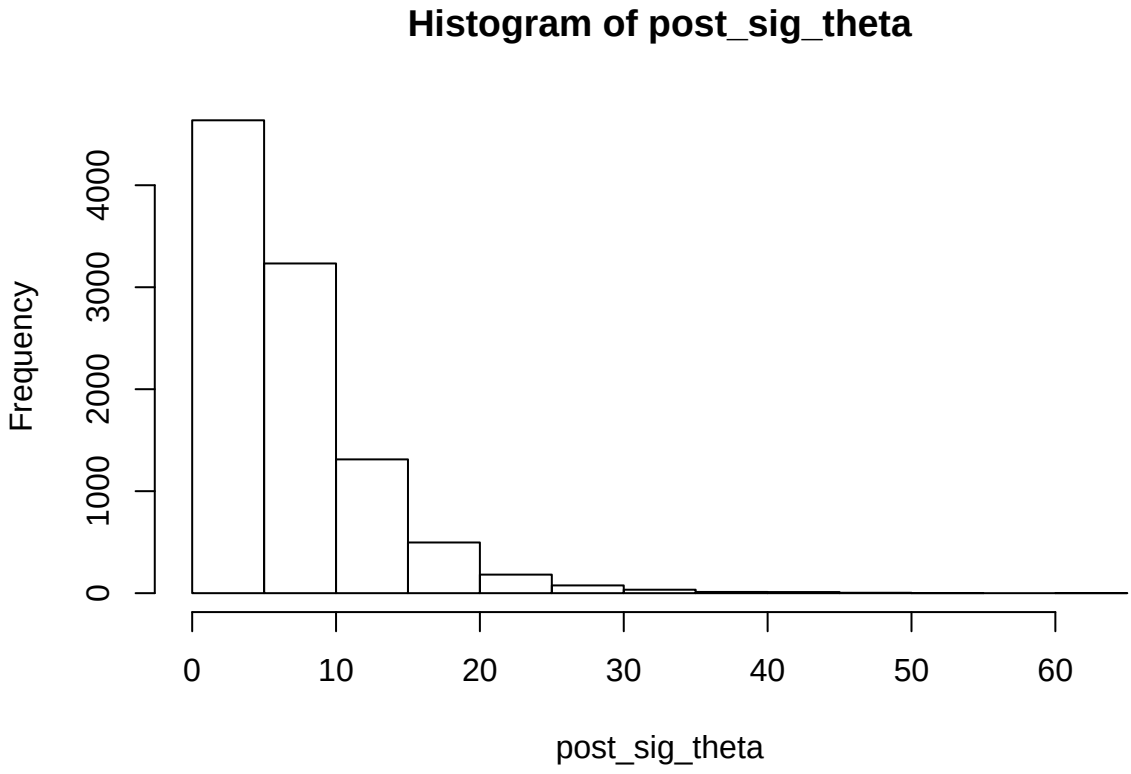
Part i - BDA Exercise 5.3

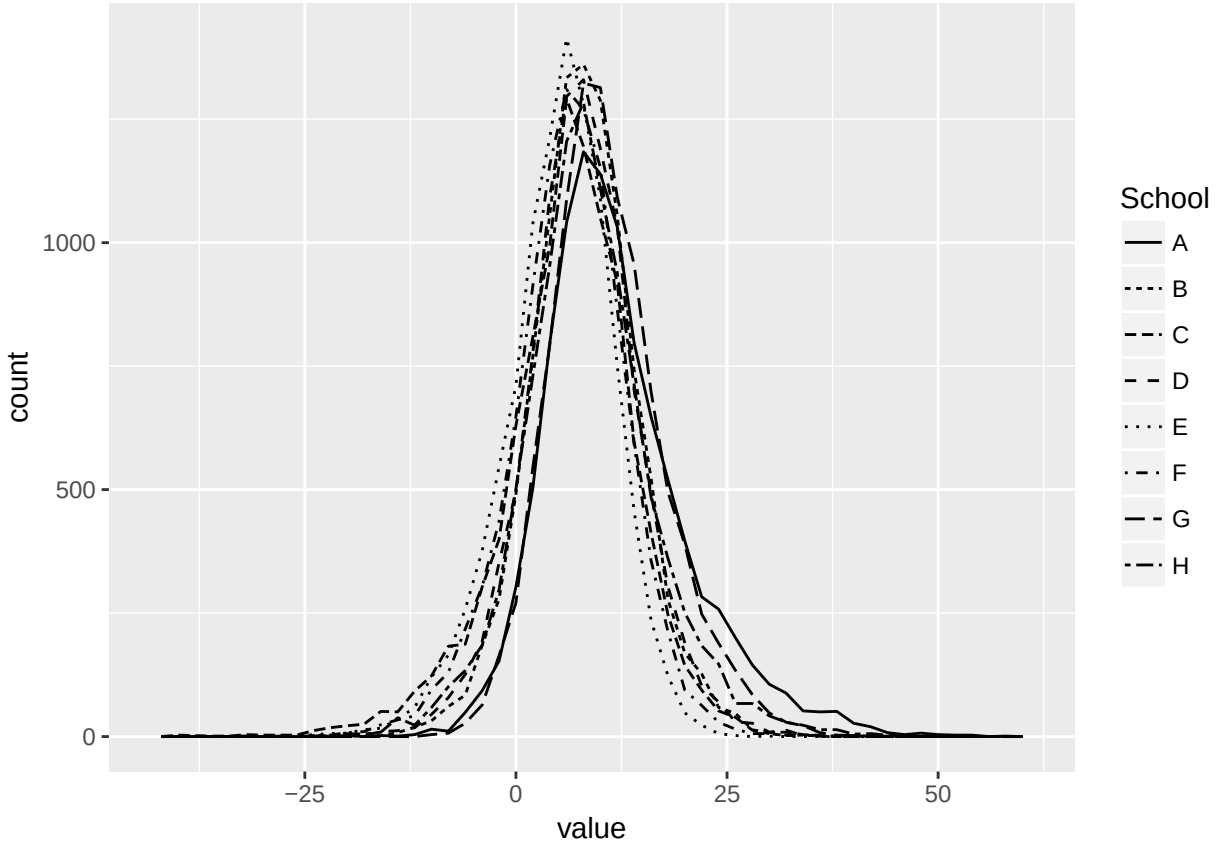
Part a

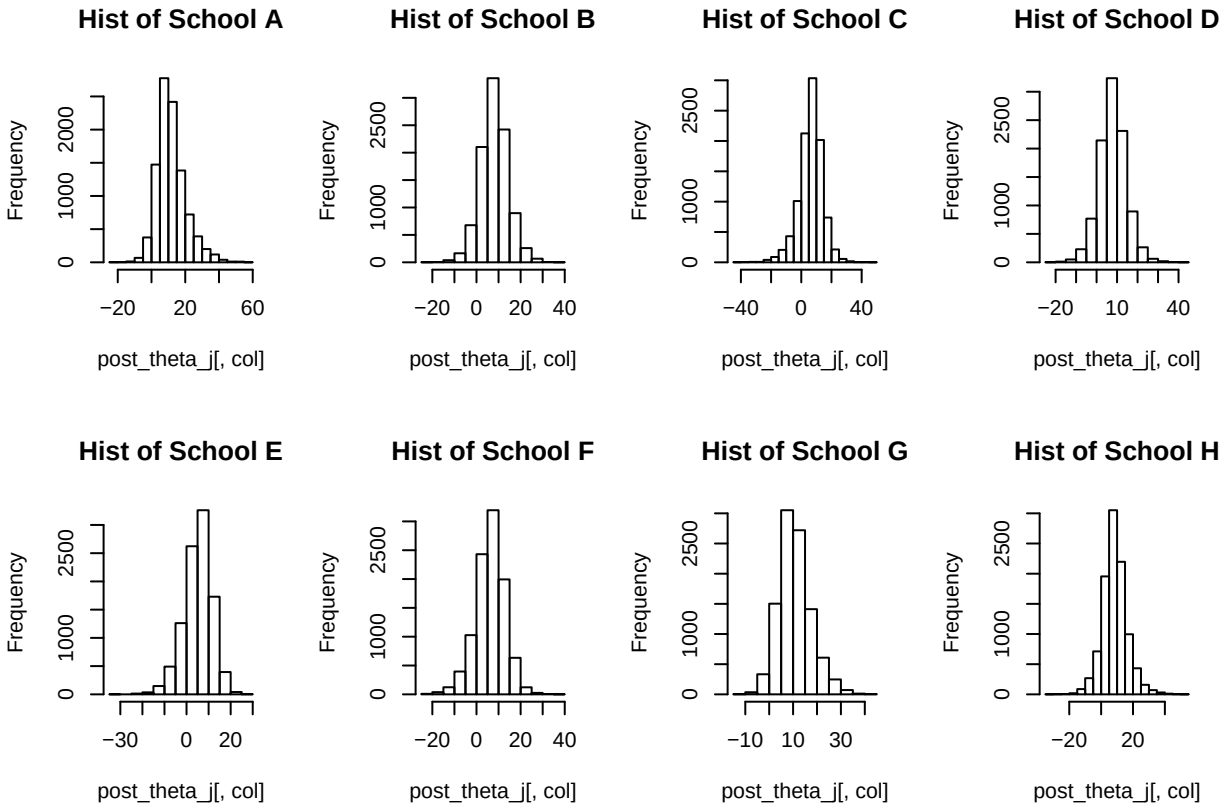
According to Formula 5.21 on BDA page 117, we have the following form for $p(\tau|y)$:
$p(\tau|y) \propto p(\tau)V_\mu^{-1/2} \prod_{j=1}^{J}(\sigma_j^2 + \tau^2)^{-1/2} exp\left(- \frac{(\bar{y}_{.j} - \hat{\mu})^2}{2(\sigma_j^2 + \tau^2)} \right)$

The following will allow us to subsitute into the equation, from Formula 5.20 on BDA page 117:
$\hat{\mu} = \frac{\sum_{j=1}^{J} \frac{1}{\sigma_j^2 + \tau^2} \bar{y}_{.j}}{\sum_{j=1}^{J} \frac{1}{\sigma_j^2 + \tau^2}}$
$V_\mu^{-1} = \sum_{j=1}^{J} \frac{1}{\sigma_j^2 + \tau^2}$


Marginal Posterior Density
p(sigma_thetaly)
0.0000000
0.0000004
0
5
10
15
20
25
30
sigma_theta

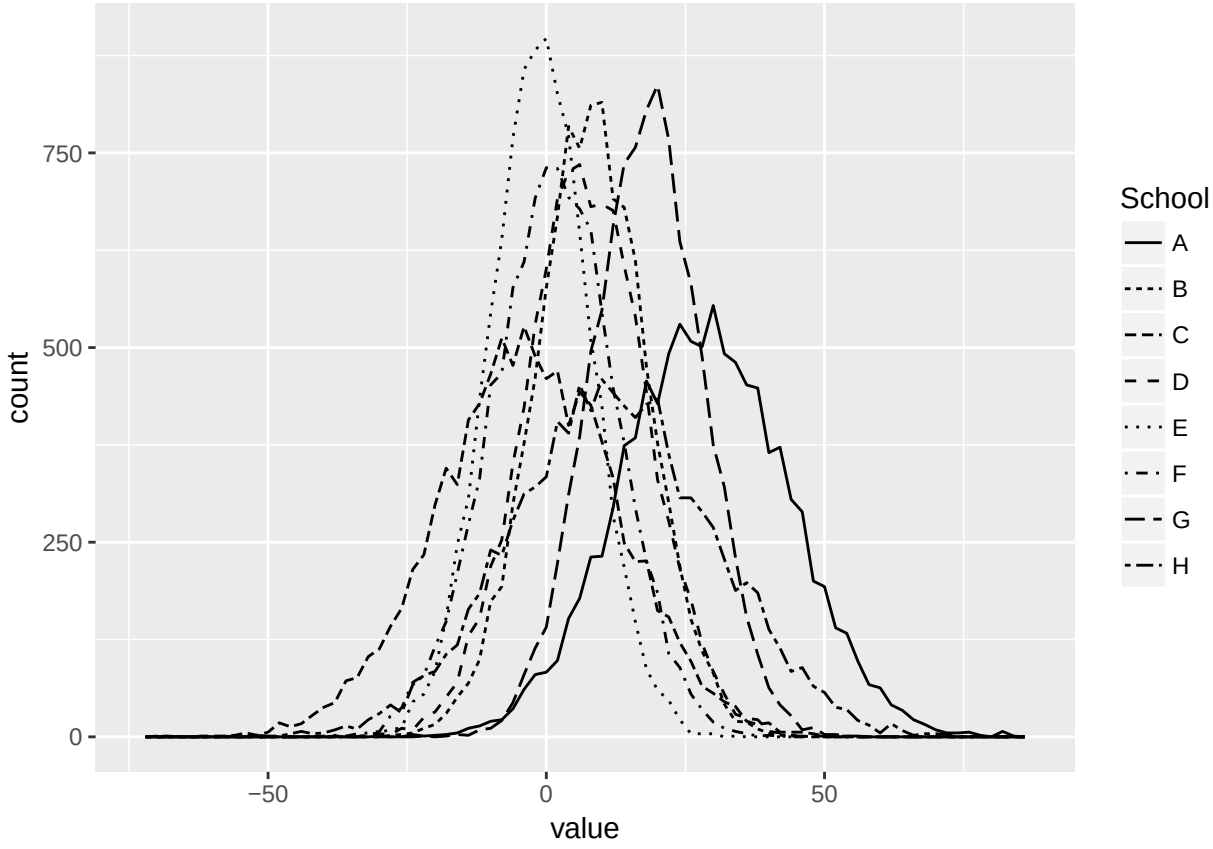

Histogram of post_sig_theta
Frequency
0
1000
2000
3000
4000
0
10
20
30
40
50
60
post_sig_theta

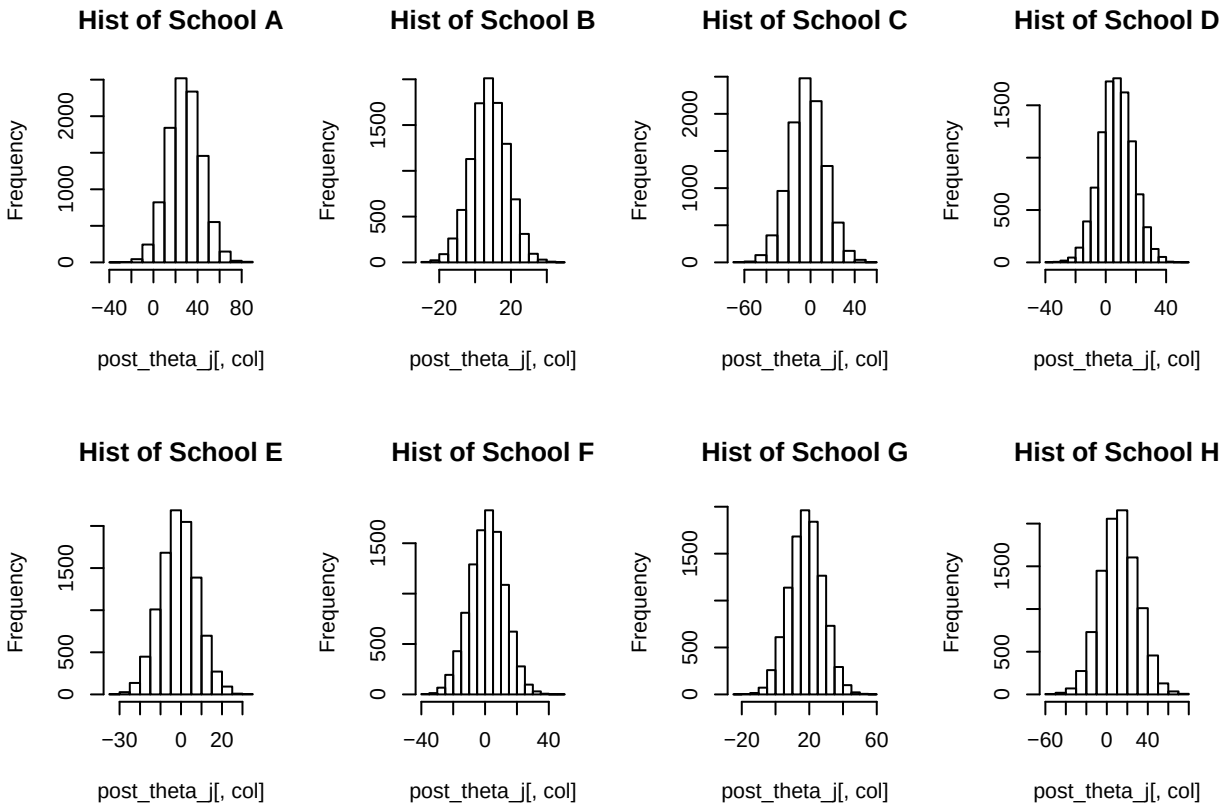

count
1000
500
0
−25
0
25
50
value
School
A
B
C
D
E
F
G
H


Hist of School A
Hist of School B
Hist of School C
Hist of School D
Hist of School E
Hist of School F
Hist of School G
Hist of School H
Frequency
post_theta_j[, col]

schools	prob_max	A	B	C	D	E	F	G	H
A	0.2661	—	0.6441	0.6865	0.6508	0.7424	0.7082	0.5322	0.6174
B	0.1037	0.3559	—	0.5761	0.5152	0.6382	0.5898	0.3791	0.4831
C	0.0807	0.3135	0.4239	—	0.4411	0.5517	0.5054	0.3245	0.418
D	0.0995	0.3492	0.4848	0.5589	—	0.625	0.5708	0.3741	0.4787
E	0.0488	0.2576	0.3618	0.4483	0.375	—	0.4504	0.2651	0.3642
F	0.0649	0.2918	0.4102	0.4946	0.4292	0.5496	—	0.3105	0.4009
G	0.2015	0.4678	0.6209	0.6755	0.6259	0.7349	0.6895	—	0.5962
H	0.1348	0.3826	0.5169	0.582	0.5213	0.6358	0.5991	0.4038	—

Part b





schools	prob_max	A	B	C	D	E	F	G	H
A	0.5537	—	0.8683	0.922	0.8711	0.9543	0.9293	0.7128	0.7529
B	0.0356	0.1317	—	0.7196	0.5319	0.7527	0.6762	0.2388	0.4255
C	0.0258	0.078	0.2804	—	0.3024	0.4515	0.4035	0.1287	0.2654
D	0.0352	0.1289	0.4681	0.6976	—	0.7235	0.6442	0.229	0.4096
E	0.0028	0.0457	0.2473	0.5485	0.2765	—	0.4285	0.0792	0.2587
F	0.012	0.0707	0.3238	0.5965	0.3558	0.5715	—	0.1308	0.3067
G	0.1665	0.2872	0.7612	0.8713	0.771	0.9208	0.8692	—	0.6225
H	0.1684	0.2471	0.5745	0.7346	0.5904	0.7413	0.6933	0.3775	—

Part c

BLAH BLAH

Part d

BLAH BLAH

Part ii

Part iii

Code Appendix