Bayesian model selection with applications in social science
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Appendix to Chapter 5: “Calculating the Bayes Factor Using R”

### For all functions:
# y is the response vector
# x is the design matrix
# R-scripts with the ANOVA examples can be found at
# www.ruudwetzels.com
###

## (1) Function to compute the Bayes Factor
## with Zellner's g-prior prior

```r
zellner.g = function(y, x, g) {
  output = matrix(, 1, 2)
  colnames(output) = c('BF_10', 'g/(g+1)')
  n = length(y)
  r2 = summary(lm(y ~ x))$r.squared
  k = dim(x)[2] - 1
  output[1] = (1 + g)^(n-k-1/2) * (1 + g*(1-r2))^-((n-1)/2)
  output[2] = g / (g+1)
  return(output)
}
```

## (2) Function to compute the Bayes Factor
## with Jeffreys-Zellner-Siow prior

```r
zellnersiow = function(y, x) {
  output = matrix(, 1, 2)
  colnames(output) = c('BF_10', 'g/(g+1)')
  n = length(y)
  r2 = summary(lm(y ~ x))$r.squared
  k = dim(x)[2] - 1
  BF.integral = function(g, n = n, k = k, r2 = r2) {
    (1 + g)^((n-k-1)/2) * (1 + g*(1-r2))^(-(n-1)/2) * g^(-3/2) * exp(-n/(2*g))
    output[1] = ((n/2)^(1/2)/gamma(1/2)) * integrate(BF.integral, 0, Inf, n = n, k = k, r2 = r2)$value
    shrinkage.integral = function(g, n = n, k = k, r2 = r2) {
      (1 + g)^((n-k-1-2)/2) * (1 + g*(1-r2))^-((n-1)/2) * g^(-1-3/2) * exp(-n/(2*g))
      g. = integrate(shrinkage.integral, 0, Inf, n = n, k = k, r2 = r2)$value
      output[2] = g. / integrate(BF.integral, 0, Inf, n = n, k = k, r2 = r2)$value
      return(output)
    }
    return(output)
}
```

## (3) Function to compute the Bayes Factor
## with Liang et al. hyper-g prior

```r
hyper.g = function(y, x, a) {
  output = matrix(, 1, 2)
  colnames(output) = c('BF_10', 'g/(g+1)')
  n = length(y)
  r2 = summary(lm(y ~ x))$r.squared
  k = dim(x)[2] - 1
  BF.integral = function(g, n = n, k = k, a = a, r2 = r2) {
```
D. Appendix to Chapter 5: “Calculating the Bayes Factor Using R”

\[(1+g)^{((n-k-1-a)/2)}(1+g*(1-r2))^{-(n-1)/2}\]

output[1]=((a-2)/2)*integrate(BF.integral,0,Inf,n=n,a=a,k=k,r2=r2)$value
output[2]=(2/(k+a))*(f21hyper((n-1)/2,2,(k+a)/2+1,r2)/f21hyper((n-1)/2,1,(k+a)/2,r2))
return(output)