***Intro to Bayes worksheet***

*Don’t worry if you can’t complete everything*. Much of the material here is adapted from Chapter 11 of my book:

Baguley, T. (2012). *Serious stats: A guide to advanced statistics for the behavioral sciences*. Palgrave Macmillan.

Alternatively there is similar coverage in:

Dienes, Z. (2008). *Understanding psychology as a science: An introduction to scientific and statistical inference*. Palgrave Macmillan.

A good step by step example can be found in:

Howard, G., Maxwell, S., & Fleming, K. (2000). The proof of the pudding: An illustration of the relative strengths of null hypothesis, meta-analysis, and Bayesian analysis. *Psychological Methods, 5*, 315-332.

**Normal distribution with known variance**

*Posterior variance:*



*Posterior mean:*



*Posterior probability (credibility) interval:*



**Some more R functions**

For unknown variance problems Berry (1995) suggests applying a small sample correction to  when *n* < 30 before calculating . Although this is an approximate solution it is a pretty good one. The functions Bayes.norm.1s() and Bayes.norm.2s() from Baguley (2012) implement the standard known variance calculations and include the small-sample correction. (These functions should already have been downloaded earlier).

|  |
| --- |
| **Q1** A new teaching technique claims to dramatically raise IQ of typically developing children. A small study observes an increase in IQ of 9.6 points with a standard error of 4.7. Your prior for the effect is an increase of 2 IQ points with SD of 5. *Assuming a normal distributed response with known variance (i.e., treat the observed SD as the population SD). Use R to calculate the posterior variance, posterior mean and posterior probability (credibility) interval:*  [I have set up the calculations for you. So this should be fairly easy!]  m.obs <- 9.6  var.obs <- 4.7^2  m.prior <- 2.0  var.prior <- 5.0^2  var.post <- 1/(1/var.obs + 1/var.prior)  m.post <- var.post/var.obs \* m.obs + var.post/var.prior \* m.prior  m.post ; var.post  m.post + c(-1,1) \* qnorm(.975) \* sqrt(var.post)  **Q2** Check your answer using the Bayes.norm.1s() function. Assume *N* = 30 and thus the SD for the sample is 25.74.  Bayes.norm.1s(9.6, 25.74, 2, 5, N = 30, ssc=FALSE, plot=TRUE)  If you have time get try the small sample correction ssc=TRUE (which relaxes the known variance assumption) or change the prior mean and variance. |