HUDM6052 Psychometric II Homework_03

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Contents

Q1

Using the item parameters given in the Table...

My Solution:
First, I write the functions about 2PL model and about the corresponding item information function.

```
> # write the corresponding information function
> iif <- function(theta, a, b){
+   # get the logit
+   Z <- a*(theta-b)
+   # get the probability
+   out <- 1/(1 + exp(-Z))
+   info <- out*(1-out)*(a^2)
+   return(info)
+ }
>
> # set the ability range
> theta <- seq(-3,3, by=0.5)
> # set the item parameters
> a <- c(2, 1.5, 1.5, 1.5, 2)
> b <- c(-1, -0.5, 0, 0.5, 1)
> # define the color
> color_set <- c("red", "green", "blue","violet","black")
>
> # plot the item information function
> info_out <- iif(theta, a[1], b[1])
> # create a vector to sum up all the information function
> test_info <- info_out
>
> # initialize the plot by plotting the first item
> plot(theta, info_out,type = "l", col=color_set[1],
+      main = "Item/Test Information and SEs",
+      xlab = "Ability", ylab = "information",
+      ylim = c(0,3))
> grid()
>
```

```
> # plot the rest item using a for loop
> for (i in 2:5) {
+   info_out_i <- iif(theta,a[i],b[i])
+   lines(theta, info_out_i, type ="l", col=color_set[i])
+   test_info <- test_info +info_out_i
+ }
>
> # draw the test information function
> lines(theta, test_info, type = "l", col="gray")
> # plot the SE
> SE <- c()
> for (j in 1:length(theta)) {
+   se_j <- 1/sqrt(sum(iif(theta[j],a,b)))
+   SE[j] <- se_j
+ }
> lines(theta, SE, type = "l", col="pink")
>
> # add a legend
> legend('topright',inset=0.05,c("item 1","item 2","item 3","item 4","item 5",
+                                "test information","SE"),
+        lty=1,col=c("red", "green","blue","violet","black","gray","pink"),
+        title="Line Type", cex = 0.5)
```