(Use 1.702 in the logistic model calculation)

1. (For Measurement PhD students) Find the maximum discrimination (slope) for item i under the three logistic models, i.e., take the derivative of $P(\theta)$ with respect to θ and evaluate at $\theta = \beta_i$.

2. Let the discrimination, difficulty and guessing parameters of five items be $\boldsymbol{\alpha} = \{0.5, 1.0, 1.5, 2.5, 1.0\}'$, $\boldsymbol{\beta} = \{-1.0, -0.5, 0.0, 0.5, 1.0\}'$ and $\boldsymbol{c} = \{0.00, 0.10, 0.15, 0.05, 0.32\}'$.

   For the following abilities: $\boldsymbol{\theta} = \{-2.0, -1.0, 0.0, 1.0, 2.0\}'$, find
   a. odds of correct response
   b. logit of correct response
   c. expected number correct
   d. expected proportion correct

3. Given the following data,

θ_j	-3.0	-2.5	-2.0	-1.5	-1.0	-.5	0.0	.5	1.0	1.5	2.0	2.5	3.0
r_j	0	0	1	2	3	4	5	6	4	4	4	2	1
f_j	1	2	4	7	8	9	10	8	6	5	5	2	1

   a. Find the maximum likelihood estimates of the item parameters under the two-parameter logistic model. Show the computations for all iterations (Use the initial values, $\zeta = 0$ and $\lambda = 1.0$).
   b. Calculate the standard errors of the estimates.
   c. Find the minimum logit χ^2 estimates of the item parameters. Calculate the standard errors of the estimates (refer to the equations in Chapter 2 in Baker & Kim (2004)). Are these close to the MLE estimates you obtained in part (a)? If not, why do you think these are different from the MLE estimates?

4. For the five items given in the Table below, the responses of an examinee are [0 0 0 1 1].

Item	Item Parameters		
	a_j	b_j	c_j
1	1.25	1.20	.10
2	1.35	.60	.15
3	1.15	.15	.15
4	1.00	-.60	.20
5	.75	-2.00	.10

   a. What is the likelihood function for this examinee? State the assumptions that must be made in determining the likelihood function.

b. Plot the likelihood function at θ values from -1.0 to 0 in increments of .1. Based on the graph, determine the maximum likelihood estimate of θ.