1. **(Problem 1.30 on page 34 of Categorical Data Analysis [second edition] by Alan Agresti)** Genotypes AA, Aa, and aa occur with probabilities $[\theta^2, 2\theta(1-\theta), (1-\theta)^2]$. A multinomial sample of size n has frequencies (n_1, n_2, n_3) of these three genotypes.

   (a) Form the log likelihood. Show that $\hat{\theta} = (2n_1 + n_2)/(2n_1 + 2n_2 + 2n_3)$.

   (b) Show that $-\partial^2 L(\theta)/\partial\theta^2 = [(2n_1 + n_2)/\theta^2] + [(n_2 + 2n_3)/(1-\theta)^2]$ and that its expectation is $2n/[\theta(1-\theta)]$. Use this to obtain an asymptotic standard error of $\hat{\theta}$.

   (c) Explain how to test whether the probabilities truly have this pattern.