(2) AA Aa aa

	AA	Aa	aa
probability in one person	θ^2	$2\theta(1-\theta)$	$(1-\theta)^2$
100 sample	20	10	70

(i) $L(\theta|x) = \prod_{i=1}^{k} p(x)$ Here $k=1$

Through binomials $p(\cancel{AA}) = {}^{100}C_{20}(\theta^2)^{20} \times {}^{80}C_{10}[2\theta(1-\theta)]^{10} \times {}^{70}C_{70}(1-\theta^2)^{70}$

$\therefore L(\theta) = p(x)$

Multinomial

~~P(Aa)~~

~~p(A=2,~~

$L(\theta) = p(AA=20, Aa=10, aa=70) = \frac{100!}{20!\,10!\,70!} \times (\theta^2)^{20} [2\theta(1-\theta)]^{10} [(1-\theta)^2]^{70}$

(ii) $\text{Log } L(\theta) = \log\left(\frac{100!}{20!\,10!\,70!}\right) + 40\log\theta + 10\log 2\theta + 10\log(1-\theta)$
$+ 140\log(1-\theta)$

c. For MLE setting $\frac{d\,l(\theta)}{d\theta} = 0$

$$\frac{d\,l(\theta)}{d\theta} = \frac{40}{\theta} + \frac{10 \times 2}{2\theta} - \frac{10}{(1-\theta)} - \frac{140}{(1-\theta)}$$

$$0 = \frac{50}{\theta} - \frac{150}{(1-\theta)}$$

~~$150\theta = 80 - 80\theta$~~ $\quad 150\theta = 50 - 50\theta$

(d.) ~~$\theta = \frac{80}{230}$~~ $\quad \theta = \frac{50}{200}$

$$\hat{\theta}_{MLE} = \frac{1}{4}$$

When applying cost function, we want to continue updating our weights until the slope of the gradient gets as close to zero as possible.

Assignment - 7

1)

$f(x) = \lambda e^{-\lambda x}$

$x = 2, 3, 1, 3, 4.$

(i)

$L(\theta) = P(x_1, x_2, x_3, x_4, x_5 \mid \lambda)$

$= P(x_1|\lambda)\, p(x_2|\lambda)\, p(x_3|\lambda)\, p(x_4|\lambda)\, p(x_5|\lambda)$

$= \lambda^5 e^{-\sum_{i=1}^{5} \lambda x_i}$

(ii) Log-likelihood

$l(\theta) = \log(L(\theta))$

$= \log(\lambda^5 e^{-\sum_{i=1}^{5} \lambda x_i})$

$= 5\log\lambda - \sum_{i=1}^{5} \lambda x_i$

(iii)

$\frac{\partial(l(\theta))}{\partial\theta} = \frac{\partial(l(\lambda))}{\partial\lambda}$

$= \frac{\partial(5\log\lambda) - \sum_{i=1}^{5} \lambda x_i}{\partial\lambda}$

$= \frac{5}{\lambda} - \sum_{i=1}^{5} x_i$

$5/\lambda - \sum_{i=1}^{5} x_i = 0$

$\sum_{i=1}^{5} x_i = 5/\lambda$

(iv)

$2+3+1+3+4 = 5/\lambda$

$\lambda = 5/13$

$\boxed{\hat{\lambda} = 5/13}$