HW6

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Problem 5

5(a)

The value of the loglikelihood under the alternative is -420.5813

5(b)

Under null, common MLE is 0.05756349, value of the loglikelihood is -454.782

5(c)

LRT statistic is 68.40151

5(d)

The dimension under alternative assumption is 2 since we have two free parameters. The dimension under null assumption is 1 since we have one free parameter. The degree of freedom is 1.

5(e)

At 0.05 significance level with degree freedom of 1, chi-square statistic is 5.02. Since LRT statistic is 68.40151 $>$ 5.02. We reject the null hypothesis that pi's are all equal.

```
## Under alternative
alpha = -2.79558
beta_alter = 0.32726
xi = c(-3,-1,1,3)
pi_alter = 1/(exp(-alpha-beta_alter*xi)+1)
cat('pi_alter:', pi_alter, '\n')
```

```
## pi_alter: 0.0223711 0.0421749 0.07810912 0.1401795
```

```
y1 = c(24,35,21,30)
y0 = c(1355,603,192,224)
l_alter = sum(y1*log(pi_alter)+y0*log(1-pi_alter))
cat('l_alter:', l_alter, '\n')
```

```
## l_alter: -420.5813
```

```r
## Under null
b_null = 0
pi_null = 1/(exp(-alpha-b_null*xi)+1)
cat('pi_null:', pi_null, '\n')
```

```
## pi_null: 0.05756349 0.05756349 0.05756349 0.05756349
```

```r
l_null = sum(y1*log(pi_null)+y0*log(1-pi_null))
cat('l_null:', l_null, '\n')
```

```
## l_null: -454.782
```

```r
## LRT
LRT = 2*(l_alter-l_null)
cat('LRT:', LRT, '\n')
```

```
## LRT: 68.40151
```