

Answers to exercises day 1

Exercise 1

- Compute HW proportions for exercises at
 - <http://genstat.epib.fgg.eur.nl>
 - Tutorial & course...
 - GE02
 - Basic genetics -> end
 -
- Any problems?

Exercise 3

- Use chi-squared test for HWE
 - <http://genstat.epib.fgg.eur.nl>
 - Tutorial & course...
 - GE02
 - Basic genetics -> end
 -
- Any problems?

Exercise 4

- Use chi-squared test and also programs HWE and HWE-EX (exact test for HWE) to test if these samples are in HWE

– $N_{DD} = 2, N_{DN} = 17, N_{NN} = 81$ $Pc=0.34$ $Pe=0.22$

– $N_{DD} = 6, N_{DN} = 29, N_{NN} = 71$ $Pc=0.15$ $Pe=0.10$

– $N_{DD} = 3, N_{DN} = 16, N_{NN} = 81$ $Pc=0.07$ $Pe=0.08$

– $N_{DD} = 1, N_{DN} = 4, N_{NN} = 95$ $Pc=0.002$ $Pe=0.07$

Why such difference?

$$N_{DD} = 1, N_{DN} = 4, N_{NN} = 95$$

$$P_c = 0.002 \quad P_e = 0.07$$

genotype	No.	Exp. prop.	Exp. no.	chi2
DD	1	0	0,09	9,2
ND	4	0,06	5,82	0,57
NN	95	0,94	94,09	0,01
Total	100			9,78
P(D)	0,03		P-value	0,0018

Exercise 2

- Test if coin is fair given that
 - $N=100$ and $K=40$
 - $N=1000$ and $K=460$
- Use
 - exact test (binomial distribution),
 - normal (chi-squared) approximation and
 - LRT

Tips

- Cumulative binomial probability ($k \leq X$) may be obtained by
`=binomdist(X,N,p,1)`
- P-value for some chi2 with m degrees of freedom can be computed in Excel by using function
`=chidist(chi2-value,m)`

Solution ex. 2.1

N	100
K	40

Exact

P(X≤40)	0,0284
P(X≤40 or X≥60)	0,0569

Normal approx. 1 (stupid)

P(X≤40)	0,0228
P(X≤40 or X≥60)	0,0455

Normal approx. 2 (Z-test)

expected – observed	10
std. dev. H0	5
Z-test	2
P(X≤40 or X≥60)	0,0455

Normal approx. 3 (chi2-test)

Chi2	4
P(X≤40 or X≥60)	0,0455

LRT

L0	7,89E-31
L1	5,91E-30
ln(L0)	-69,31
ln(L1)	-67,3
2*(ln(L1)-ln(L0))	4,0271
P(X≤40 or X≥60)	0,0448

[=BINOMDIST(B12;B11;0,5;1)]

[=B15*2]

[=NORMDIST(B12;B11/2;SQRT(B11/4);1)]

[=B18*2]

[=B11*0,5-B12]

[=SQRT(B11*0,5*0,5)]

[=B20/B21]

[=2*(1-NORMDIST(B22;0;1;1))]

[=2*(B12-B11/2)^2/(B11/2)]

[=CHIDIST(B25;1)]

[=0,5^B11]

[=(B12/B11)^B12*(1-B12/B11)^(B11-B12)]

[=LN(B28)]

[=LN(B29)]

[=(B31-B30)*2]

[=CHIDIST(B32;1)]

Solution ex. 2.2

- $N = 1000, K = 460$
 - Exact binomial $P = 0.0124$
 - Normal approximation $P = 0.0114$
 - LRT $P = 0.0114$