Linköpings Universitet
IDA/Statistik
LH

Exam in Statistical Methods, 2014-12-17

Time allowed: kl: 8-12

Allowed aids: Calculator. One handwritten A4 paper (both sides) with the students own notes.

Assisting teacher: Lotta Hallberg

Grades: A=19-20 points, B=17-18p, C=14-16p, D=12-13p, E=10-11p

Provide a detailed report that shows motivation of the results.

1

Let $f(y|\alpha,\beta)=\frac{1}{\alpha}e^{\frac{-(y-\beta)}{\alpha}}$, $\beta<y<\infty$, $0<\alpha<\infty$ be density function to the random variable *Y*, α and β are parameters

a) Show that $f(y\,|\,\alpha,\beta)$ is a density function. 2p

b) Determine the distribution function 1p

c) Calculate the probability $P(\beta+1<Y\leq\beta+2)$ when $\alpha=2$ 1p

2

Let the bivariate random variable (X,Y) have density function:

$f(x,y)=k(x+2y)$ where $0<2y<x<2$.

a) Determine *k*. 2p

b) Calculate $E[X\,|\,Y=\frac{1}{2}]$ 3p

3

A company's management want to investigate the stress level of the employees. Therefore they check with 40 randomly selected employees and ask if they feel stress at work and 8 of them answered yes. Assume that the total number of employees is very large.

Estimate the proportion *p* of stressed employees in the company using:

a) Method of moments. 1p

b) Maximum Likelihood method. 2p

c) Bayes method. Use the conjugate beta prior, beta(2,4) 2p

d) Test the hypothesis $H_0: p=0{,}15$ against $H_a: p>0{,}15$ using the observation above. Use large sample theory. 10% significance level. 2p

4

The following data are measured on 7 female runners.
Step = average number of steps per second
m/s = running speed, meters per second.
A runner are assumed to be good if the number of steps per second increase with the speed.

Step=Y	m/s=x
3.05	4.76
3.12	5.06
3.17	5.25
3.25	5.59
3.36	5.99
3.46	6.32
3.55	6.63

a) Set up the simple linear regression model and estimate the regression parameters β_0 and β_1. 2p

b) Test if the slope is zero. You may use without showing any calculations that SSE= 0,00043. Use 5% significance level. Interpret your result. 2p