

Written Exam for the B.Sc. in Economics
summer 2011

Econometrics A

2. year

June 14th 2011

(3-hour open book exam, calculators are not
allowed)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by “eksamen på dansk” in brackets, you must write your exam paper in Danish.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students’ self-service system.

Question 1

Customers arrive at the rate of 1 per minute to the check-in desk at the local airport.

1. What is the probability that more than 15 customers entering within 10 minutes? What is the expected number of check-in a ten-minute period?

The check-in desk receives independently two types of travelers, for destination A and destination B. The rate of arrival of travelers to destination B is 0.8 per minute.

2. What is the rate of arrival of travelers to destination A? What is the probability that a random individual arriving at the desk is of Type A. Conditional on 4 arrivals calculate the probability of one is of type A.

The staff at check-in can service 15 customers in a ten-minute interval. The travelers are serviced in the order they arrive. The traveling company promises that no waiting time can be expected for travelers to destination A.

3. What is the probability that customer load will exceed capacity for exactly one traveler to destination A.

Hint: As queues longer than 7 customers are very unlikely you are allowed to calculate the probability by considering the number of type A customers for queues between 1 and 7 customers.

Question 2

The distribution of females on participation in the labor force and number of children in a given year is:

| | No children | 1 child | 2 children | 3 or more children |
|----------------|-------------|---------|------------|--------------------|
| participate | 0.18 | 0.24 | 0.28 | 0.06 |
| No participate | 0.02 | 0.06 | 0.12 | 0.04 |

Let W be a stochastic variable for participation and C be a stochastic variable for number of children.

1. What is the probability of participation given the number of children?

The joint distribution of age and children in a given year is given by,

| | No children | 1 child | 2 children | 3 or more children |
|-------------------|-------------|---------|------------|--------------------|
| 20 – 29 years old | 0.10 | 0.15 | 0.05 | 0.00 |
| 30 – 39 years old | 0.10 | 0.10 | 0.15 | 0.05 |
| 40 – 49 years old | 0.00 | 0.05 | 0.20 | 0.05 |

Let A be a stochastic variable for age. Assume independence between W and A conditional on C . That is $P(W|A, C) = P(W|C)$. The probability of participation for females of age 20 – 29 years old and 30 – 39 years old are respectively 0.816667 and 0.7625.

2. Calculate the probability of participation given age is 40 – 49 years old.
3. Why is the probability of working changing with age?

Question 3

In a survey 633 employees were asked if they suffered from a headache at least 1 – 2 times a month. 109 out of the 633 persons answered yes to the question, the rest answered no.

Let X denotes the number of people, who have answered to the question.

1. Explain why X can be described with a binomial distribution
2. Calculate the estimate for p , where p is the probability that a random chosen person suffers from a headache. Explain which properties the estimator has.
3. Calculate the corresponding 95% confidence interval for the estimator
4. Test the hypothesis that $p < 0.25$

The 633 selected persons have been placed into categories based on the person's education level. The following categories have been used.

Category A: less than 7 years of education

Category B: 7 – 12 years of education

Category C: academic

The following table shows how the 633 persons are distributed.

| Category A | Category B | Category C | total |
|------------|------------|------------|-------|
| 124 | 248 | 261 | 633 |

From the previous surveys it has been established that 20% will be in category A, 40% in category B and 40% in category C.

5. Test the hypothesis that 20% will be in category A, 40% in category B and 40% in category C

The following table shows the simultaneous distribution of education and the answer to the question about headache.

| Headache | Category A | Category B | Category C | total |
|----------|------------|------------|------------|-------|
| yes | 19 | 52 | 38 | 109 |
| no | 105 | 196 | 223 | 524 |
| total | 124 | 248 | 261 | 633 |

6. Test if headache is independent of education.