Harald Schmidbauer
Sema Bayraktar
Yonca Demİr

İstanbul Bilgi Üniversitesi

# Bus 274: Further Statistics for Business

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## PROBLEM SHEET # 2

**Problem 1:** A fish basin contains 30% bluefish and 70% bream. Three fish are randomly caught (randomly selected without replacement). Let $X$ = number of bream among the three.

a) Suppose the basin is small and contains only 10 fish (3 bluefish, 7 bream). What is the distribution of $X$?

b) In the case of (a), write the probability that one fish is a bluefish and two are breams.

c) Now suppose the basin contains 100 fish (30 bluefish, 70 bream). Which discrete distribution can be used as an approximation for the distribution of $X$? (Give reasons for your answer. Give the values of all parameters.)

d) How should the fish be caught (how should they be randomly selected) so that the distribution in (c) is the *precise* distribution of $X$?

**Problem 2:** An online shop has observed that 10% of those visitors looking for a certain CD finally buy a CD. Let $X$ = number of those among the next $n$ visitors who buy a CD.

a) What is the distribution of $X$?

b) Considering the next 5 visitors, what is the probability that at least two of them will buy?

c) Considering the next 1000 visitors, compute the parameters of the normal distribution approximating the distribution of $X$.

d) In the case of (c), give an interval such that $X$ will be in this interval with a probability of about 2/3. (Hint: One of the following will be helpful: $8.5^2 \approx 72$, $9.5^2 \approx 90$, $10.5^2 \approx 110$.)

e) The number 50 is outside the interval of (d). What does this mean with respect to observations of $X$? (You can support your argument with an illustration of the density of $X$.)

**Problem 3:** One of the items used in a car repair shop is a certain type of windshield. The repair shop needs an average of 2 units of this windshield per month. We assume that demand in different months is independent.

a) Why is it reasonable to consider $N$ = *monthly demand of this windshield* a random variable?

b) Explain why we can assume that $N \sim \text{Po}(\lambda)$. — What is the value of $\lambda$ in this case?

c) Write the expression, with the correct parameter, for the probability that no unit will be needed during a month, that is: $P(N = 0)$.

d) Write the expression, with the correct parameter, for the probability that more than three units will be needed during a month, that is: $P(N > 3)$.

e) Let $X$ = length of the time interval (in days) between two successive requirements of the windshield. Find the distribution of $X$.

f) Let $M$ = required number of units of the windshield in a year. Find the expectation and the variance of $M$.

g) Demand for the windshield was above average in December. What does this mean for demand in January? Discuss briefly. (Hint: Refer to the assumptions made above.)

h) Why is it useful to analyze windshield demand in car repair shops? Discuss briefly.