

Statistical Applications in Production
PRE5324

Final May 2013, 3rd Year at Production Engineering and Mechanical Design Department.
Please solve the next problems. (Time: 3 hrs.)

1-[20 marks]-The thickness, in mm, of a particular metal part of an optical instrument was measured on 121 successive items as they came off a production line, as shown below.

- Construct the most suitable frequency distribution for these data.
- Use the histogram and cumulative frequency polygon to explain this production process.

3.40 3.21 3.26 3.37 3.40 3.35 3.40 3.48 3.30 3.38 3.27
3.35 3.28 3.39 3.44 3.29 3.38 3.38 3.40 3.38 3.44 3.29
3.37 3.41 3.45 3.44 3.35 3.35 3.46 3.31 3.33 3.47 3.33
3.37 3.31 3.51 3.36 3.32 3.33 3.43 3.39 3.39 3.28 3.33
3.25 3.28 3.30 3.41 3.39 3.33 3.27 3.34 3.33 3.42 3.35
3.34 3.32 3.42 3.31 3.38 3.44 3.37 3.35 3.57 3.41 3.28
3.49 3.26 3.44 3.46 3.32 3.36 3.41 3.39 3.38 3.26 3.37
3.28 3.35 3.36 3.34 3.42 3.38 3.39 3.51 3.44 3.39 3.36
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3.37 3.33 3.39 3.30 3.35 3.38 3.38 3.27 3.31 3.32 3.45
3.49 3.45 3.38 3.41 3.35 3.39 3.24 3.35 3.34 3.37 3.37

2-[15 marks]-A manufacturer uses three identical production lines to produce a product. The first line and the second line produce 30% and 45% of the output, respectively. The product needs to three types of machinery M1, M2, and M3. The probabilities that the machines produce defective components are 1% for M1, 2% for M2, and 3% for M3. A unit is selected randomly from a large batch, and this unit is supposed defective, find the probability that the first or second line produced it.

3-[20 marks]-Suppose that X and Y are two random variables having joint density function defined as

$$f_{XY}(x, y) = \begin{cases} cxy(x+y), & 0 \leq x \leq 4, 1 \leq y \leq 4 \\ 0, & \text{otherwise} \end{cases}$$

where c is a real constant.

- Find $F_{XY}(x, y)$.
- Find $P([X + Y] \leq 4)$.

4-[15 marks]-A large truck is equipped with twelve tires double distributed on both sides. Suppose that the tires perform independently with reliability p for each. Find the reliability of the tire system.

My best wishes...Prof. Dr. Hassan Soltan