

Write full sentences using clear and readable fonts

1. A factory manufactures 200 products a year starting from raw materials. Average throughput time from start to completion is 5 weeks and manufacturing cost is about 100 000 euros/product.
  - a) What is the average value of work in process?
  - b) What is the average number of products found at the factory (incomplete or complete) at any time?
  - *From Little's law: b) WIP is about 19 – 20 pieces, a) Because manufacturing starts from raw materials, WIP in euros is less than  $19 \times 100\,000$  euros, somewhere between 0,5 ... 1 times 1 900 000 euros. Probably about 1 000 000 euros.*
2. Compare linear regression modeling and neural network modeling. What is the purpose of such modeling? What are the main characteristics of each, how do they differ and give examples of typical applications for both of them.
  - *Generally input-output models fitted to data. Used for cost, work content estimation, process modelling, stock exchange price prediction etc. Easy to use.*
  - *Linear regression: linear, goodness of fit can be evaluated with defined statistics, model provides information about the process (system behavior).*
  - *Neural networks: can be used for complicated, nonlinear systems, "black box" character, can be unpredictable. Need a lot of data for fitting.*
3. Describe production control using priority rules. Describe typical rules. Why are they used? What are the advantages and disadvantages of such a system compared to real optimization when making production scheduling decisions?
  - *Priority rules: robust, reactive, easy to use, non-optimal.*
  - *Real optimization: Difficult, may produce very good results if successful.*
4. How can
  - a) average throughput time,
  - *SPT*
  - b) maximum tardiness,
  - *EDD*
  - c) total tardiness
  - *Only by optimization, but for loose cases SPT and for tight cases EDD are usable.*

be minimized for a single machine? You do not need to specify models in detail, just describe principle. Describe the assumptions you make concerning your system.

  - *The system cannot have extra constraints like earliest starting time for a) and b) to hold.*