СЕКЦІЯ 1
МОДЕЛЮВАННЯ, АНАЛІЗ ТА ОПТИМІЗАЦІЯ СКЛАДНИХ СИСТЕМ

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BEAUTY CENTER MODELING AND OPTIMIZATION

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Today, people are increasingly striving to have a good appearance. This becomes a great incentive for the opening of new beauty centers. From the point of view of demand, the salon business is highly promising [1], but to ensure profitability certain organizational measures are required, in particular the number of masters.

Three quarters of the clients of beauty centers are women, and the rest are children and men. In general, clients create a flow of requests for services provided by the masters of the beauty center. Thus, the beauty center operates in the mode of mass service and the theory of queues can be used to evaluate its effectiveness.

Customer service is provided by beauty center masters, customers can wait their turn for service in comfortable chairs. If a beauty salon is located in a place with a large concentration of people, such as a market, its customers are mainly random people who come at random moments of time. Thus, the clients of the beauty center form a random flow of events that can be described by a distribution function.

The beauty salon offers the following types of services:

- Hairdressing services: dyeing, highlighting, extensions, hair straightening, various hairstyles and styling, hair care;
- Nail service: manicure, pedicure, coating with gel varnish, shellac, nail extensions;
- Depilation of the body with wax, sugar (sugaring);
- Classic, relaxing, anti-cellulite massage;
- Facial tattooing, correction and coloring of eyebrows and eyelashes.

From the perspective of an outside observer, the service time of each customer is random and can be described by a distribution function.

Thus, a multi-line queuing system with a limited queue can be used as a probable model of the beauty salon operation process. The masters of the center will act as service devices. To describe the flow of events, we will use the exponential distribution (Poisson flow), in which the system operates in the most loaded mode. That is, the M/M/n/m model in Kendall's classification was chosen for research. Its characteristics are as follows [2]:

– probability of system downtime:

$$p_0 = \left[\sum_{i=0}^{n-1} \frac{n^i \rho^i}{i!} + \frac{n^n}{n!} \frac{\rho^n (1-\rho^{m+1})}{1-\rho} \right]^{-1}, \tag{1}$$

– probability of service refusal;

$$P_{vidm} = p_{m+n} = (n^n / n!) \rho^{n+m} p_0, \tag{2}$$

- Probability of customer service: $P_{obsl} = 1 - P_{vidm}$.

The queuing system models the economic system in which requests are served, then for its optimization you can use the criterion – the profit from the operation of the queuing system per work shift – G:

$$G = 8\lambda C_s P_{obsl} - (8\lambda C_s P_{vidm} + z \cdot n), \tag{3}$$

Where C_s is the average cost of servicing each request, that is, it is the gross profit received during the service of each request, z is the average salary of a master for a work shift. Optimization will be carried out by the number of service channels n. Since the main parameters can be determined quite roughly, it is advisable to solve the optimization task graphically by constructing a dependence graph $G = f(n)$. Figure 1 shows the graph of the dependence of the profit of the beauty salon on the number of masters, under the following conditions: $\lambda = 3{,}8,\ \mu = 4,\ m = 3,\ C_s = 400\ UAH, z = 300\ UAH$.

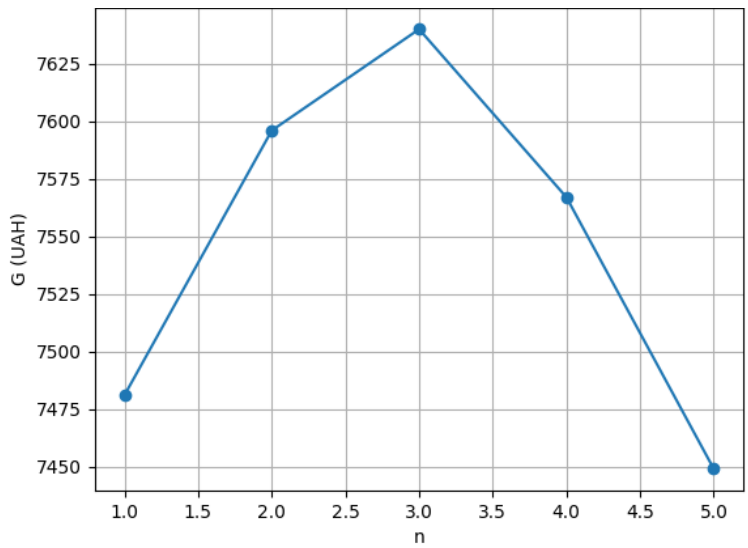

Figure 1 – Dependence of the profit of the beauty salon on the number of masters

From the graph it follows that the manager should hire three masters to ensure the maximum profit of the beauty center.

Conclusion. When organizing a beauty center, it is advisable to conduct its simulation in advance with the help of mass service systems in order to pre-calculate the parameters of the salon.

References

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USING GIS TECHNOLOGIES FOR SOLVING OPTIMIZATION PROBLEMS IN HUMANITARIAN LOGISTICS

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The efficiency of humanitarian logistics is crucial, especially in emergencies or when distributing limited resources. A key task is optimally placing collection centers to minimize distances and costs. This task is complex due to various criteria, such as estimating the number of users and considering the service market's characteristics. There is a need for further research on developing methods for analyzing and evaluating locations. Decisions should consider regional features like population density and road network density. Traditional methods may not account for all real-world aspects, leading to unsuitable locations. Geographic Information System (GIS) technologies are vital in addressing these challenges, as they enable the consideration of geographical constraints in the planning stage [1]. Integrating optimization algorithms with GIS can enhance the process of determining efficient and practical locations for collection centers.

Determining the optimal locations for collection centers requires considering various criteria [2], among which are: