Mathematical and Computer Modeling of Biological Processes

Practice 10

Consider a model with two bacterial strains, b_1 (nonresistant) and b_2 (antibiotic resistant), from Lecture 11.

Take the following values of the model parameters: $\lambda_1 = 2.7$, $\lambda_2 = 0.9$, $v_1 = 3$, $v_2 = 1$, $\alpha_1 = 2$, $\alpha_2 = 0.2$, $M = 1$, $T = 28$, and

$$P(b_1, b_2, 0) = \begin{cases} 3 & \text{if} \quad 1 \le b_1 + b_2 \le 2, \\ 0 & \text{if} \quad b_1 + b_2 < 1 \ \text{ or } \ b_1 + b_2 > 2. \end{cases}$$

Task. Compute the total amount of the antibiotic-resistant bacterial strain, $Q_2(T)$, for two treatment strategies:

1) $h(t) = 5$ if $0 < t \le 14$, $\quad h(t) = 0$ if $14 < t \le 28$;

2) $h(t) = 10$ if $0 < t \le 7$, $\quad h(t) = 0$ if $7 < t \le 28$.

Determine which of the two treatments yields a smaller $Q_2(T)$. Plot the results.

(4 points)