MATH 495: Mathematics of Cancer

Quiz 3

NAME: _____ Date: March 1, 2018

Answer the following questions on this sheet of paper. No calculators or other electronic devices are permitted.

1. (5 points) What are the four stages of the cell-cycle? At what point may a cell enter the non-dividing state of quiescence?

2. (5 points) Consider the basic model of cell-cycle dynamics considered in class:

$$\begin{aligned} \dot{P} &= (\beta - r_0(N))P + r_i(N)Q, \\ \dot{Q} &= r_0(N)P - (r_i(N) + \mu_q)Q. \end{aligned} \tag{1}$$

   Here $\beta > 0$ is the net division rate. **Assume that the rate of transition to quiescence is slower than the net division rate.**

   (a) In terms of the terms in system (1), what does the above assumption imply? That is, what mathematical relations exist among the defined quantities?

   (b) What do you expect in terms of the behavior of the total tumor population $N(t) := P(t) + Q(t)$? Can you prove this?