Example of 2008 SCIE1000 assignment question

Consider the stage-classified model of loggerhead sea turtles as given in lectures. In the following questions, use the transition matrix T and the initial population matrix given in the lecture notes. (You can calculate the initial population matrix $P1$ by multiplying the total global population of 7 million sea turtles by the proportions in each life stage.)

(a) Draw a life-cycle graph for the sea turtle. Your diagram should should show all possible transitions between states, with correct values marked on each transition.

(b) Write a Python program to predict the population of sea turtles in each life stage at time $i = 2$ (so after 1 year). Also print the total population size at $i = 2$, and the change in total population size during that year.

(c) Compare the **proportions** of the total population of sea turtles in each stage at time $i = 2$ with the corresponding proportions at time $i = 1$. What do you notice, and what does this mean?

(d) If A is a matrix, X is a column vector and l is a scalar, all satisfying $AX = lX$, then l is called an eigenvalue of A with corresponding eigenvector X.

> (i) Find an eigenvalue of the sea turtles' transition matrix T, along with its corresponding eigenvector.

> (ii) Explain how you could use your results from Part (i) to predict the total global population of sea turtles in 30 years, and predict this value. What does this mean?