In-class activity 24

This assignment is worth a maximum of 3.0 points, and is due in class today. No in-class assignment is accepted after the end of class.

Work cooperatively and collaboratively as a team on this in-class assignment. Each person in your group will be awarded the same points as the entire assignment. *Turn in this sheet at the end of class, and attach another page if necessary.*

Assemble Your Group

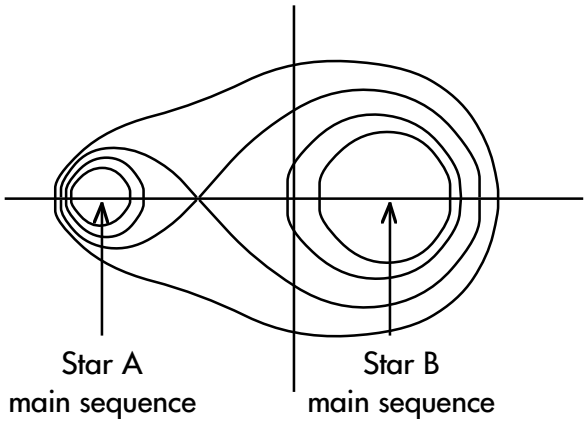
1. [0.5 points.] Find your assigned group members, and sign in below.

Team member: _____ Team member: _____

Team member: _____ Team member: _____

Binary System Mass Transfer

2. [1.5 points.] (*Cf.* Figs. 21.13, 21.15, 21.16, on pages 501-503 in Fix, *Astronomy: Journey to the Cosmic Frontier, 4/e.*) Consider a close binary system with two main sequence stars, shown with their equipotentials and Roche lobes.



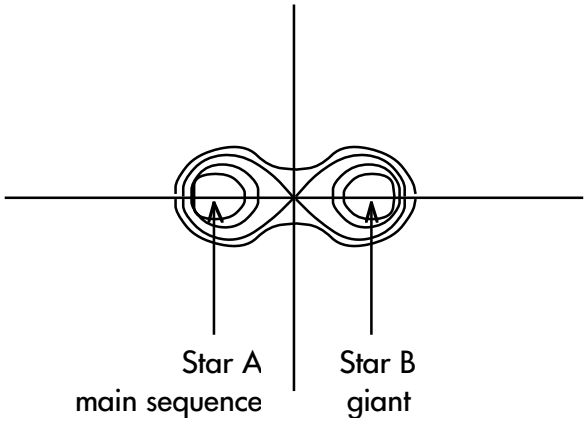
(a) Briefly explain how you can tell from their center of mass distances that Star B is more massive than Star A.

(b) Briefly explain why Star B will leave the main sequence and become a giant first before Star A does.

(c) Color in the equipotential that Star B must expand to as it becomes a giant that will result in mass being transferred to Star A.

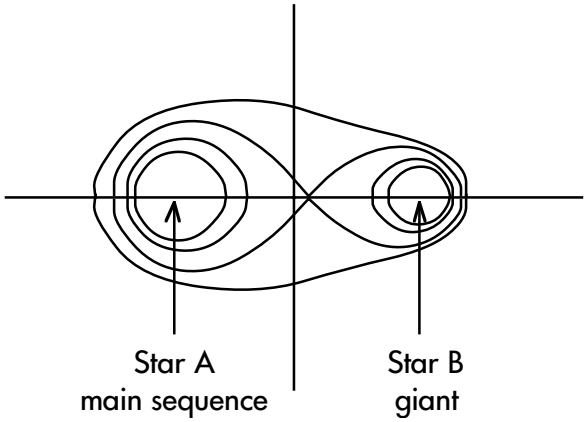
(d) During this mass transfer from Star B to Star A, their masses become $\begin{bmatrix}\text{unequal}\\ \text{equal}\end{bmatrix}$, making their separation distance $\begin{bmatrix}\text{increase}\\ \text{decrease}\end{bmatrix}$ and their orbital speeds $\begin{bmatrix}\text{increase}\\ \text{decrease}\end{bmatrix}$. This $\begin{bmatrix}\text{increases}\\ \text{decreases}\end{bmatrix}$ the size of Star B's lobe, and results in mass being transferred $\begin{bmatrix}\text{quickly}\\ \text{slowly}\end{bmatrix}$ to Star A.

(e) So far enough mass has transferred from Star B to Star A such they have equal masses. Color in the equipotential that Star B must have (while still in its giant phase) in order to continue to transfer mass to Star A.



(f) If mass transfer continues from Star B to Star A, their masses become [unequal / equal], making their separation distance [increase / decrease] and their orbital speeds [increase / decrease]. This [increases / decreases] the size of Star B's lobe, and results in mass being transferred [quickly / slowly] to Star A.

(g) Now enough mass has transferred from Star B to Star A such that Star B is less massive than Star A. Color in the largest equipotential that Star B must have (still in its giant phase), while no longer transferring mass to Star A.



3. [1.0 point.] If you were to survey every visible close pair ("mass-exchanging) binary star system, which one of the choices (A)-(D) would best describe your observations?

I. Mass being transferred from a more-massive star to a less-massive star.
II. Mass being transferred from a less-massive star to a more-massive star.

(A) You would see (I) more often than (II).
(B) You would see (I) just as often as (II).
(C) You would see (II) more often than (I).
(D) You would *only* be able to see (I), as it is impossible for (II) to occur.