**BIO-366 Assignment-3 Due September 15, 2020 5.00 pm**

**NAME: Arun Krishnaraj UT EID: ak37738**

**1-A**. Did we cover all possible meiotic segregations in class?

If not, which ones did we omit? (see hint below)

We did not cover the meiotic segregations of 7:1 or 8:0 in class.

**1-B**. Choose one of these segregation modes, and explain how you might account for its occurrence.

Considering 8:0 meiotic segregation, we would have to fully excise one color of strand (red for simplicity). The double strand gap repair model describes donor and recipient strand interactions, resulting in replacing 2 green segments with 2 red donor segments. Since this would result in 6:2 segregation, we could imagine the 2 remaining green strands experiencing a double break and being replaced with red donor strands. These two double strand gap repair events would result in 8:0 segregation.

**1-C**. Can you think of a reason why we might not have considered these segregation types?

One reason could be that the probability of two double strand gaps being formed in the same coding region is incredibly low; double strand break probability is already very small, and since the two events are independent the chance of observing two at the same location is effectively zero.

[**Hint**: There are a total of 4 Duplex DNAs (chromosomes) or 8 DNA strands in total capable of exchanging information between partners. To start with we have a 4 red strands (carrying pigment synthesis information) and four green strands (mutated for this information). Exchange of information between green and red strands can change the colors of strands but the total number of strands will always be 8.]

**2**. The diagram below shows the exchange of a pair of strands between two DNA duplexes to form a Holliday junction.



The paired red and pale red (orange) strands as well as green and pale green strands indicate homologous DNA.

The paired green/orange and red/pale green strands denote heteroduplex DNA.

The flanking markers on the parental homoduplexes are: L1 and R1 for the red/orange DNA and L2 and R2 for the Green/pale green DNA. L and R stand for 'left' and 'right', respectively.

**2-A**. Which direction (left to right or right to left) is the junction migrating to give the heteroduplex shown in the top right panel?

Left

**2-B**. Which is the migration direction to give the heteroduplex shown in the bottom right panel?

Right

**3**. In the diagram below I have indicated the modes of resolution of a double Holliday junction.

**3-A**. Which of the resolution modes (I) or (II) will yield cross-over of the flanking markers?

**II**

**3-B**. Which of the resolution modes (I) or (II) will yield parental configuration of the flanking markers?

**I**

**3-C**. After resolution shown in **I**, the markers on the two chromosomes will be:

A-------b and a-------B. TRUE or FALSE?

**False**

**3-D**. After resolution shown in II, the markers on the two chromosomes will be:

A-------B and a--------b. TRUE or FALSE?

False

**4**. The diagram below shows the resolution of three Holliday junctions formed between two DNA duplexes.

What will be the marker arrangements in the two chromosomes following resolution?

A---B---c---d and a---b---C---D