BSCI 411 Mid-term exam. March 14, 2002

Exam is due on March 19 at 9:30AM.

Your name: _____ ; **SS#** _____

1. To create new types of *Arabidopsis* flowers, Mr. Franks generated four different (a-d) transgenic plants that harbor following transgenes. Please fill in the floral organ type in each of the four floral whorls as well as in presumptive leaves. (Hint: The A, B, C, E genes refer to the floral genes described in lecture 12). wt: wild-type plants. *ag*: a class C mutant.

	Whorl 1	Whorl 2	Whorl 3	Whorl 4	leaves
(a) 35S:C in wt plants					
(b) 35S:B, 35S:C, and 35S:E in wt					
(c) 35S:B in wt					
(d) 35S:B in *ag* mutant plants					

2. You have isolated five recessive maize mutants (**d1-d5**) which are defective in pigment biosynthesis. While wild type kernels are Red (R) in color; these **d1-d5** mutant kernels are Yellow (Y) in color. To test if any of these mutations are allelic to each other, you did pairwise crosses among all five mutations and observed F1 phenotypes which are summarized in the table below. How many genes are represented by these five mutations? How are these five mutations grouped into different genes?

	d1	d2	d3	d4	d5
d1	Y	R	R	Y	R
d2		Y	R	R	R
d3			Y	R	Y
d4				Y	R
d5					Y

(R: red; Y: Yellow)

3. Ethylene is a plant hormone that facilitate fruit ripening. Two types of tomato mutants were isolated that either could not ripen even when exposed to ethylene treatment or could ripen even without ethylene treatment. To determine the epistatic relationship among these mutations, double mutants were constructed and their phenotypes were observed and summarized below.

Gene names	Single mutant phenotype:
never red (nrd):	Form green tomatos even after ethylene treatment
never ripen (nrp):	Form green tomatos even after ethylene treatment
always ripen (ar):	Form red tomatos even without ethylene treatment

(*nrd*, and *nrp* are defective in different genes).

Gene names	Double mutant phenotype:
nrd ar:	Form green tomatos even after ethylene treatment
nrp ar:	Form red tomatos even without ethylene treatment

What is the regulatory relationship among these three genes? (Draw the regulatory pathway starting with "Ethylene" and ending with "tomato ripening". Use arrows to indicate positive regulations and bars (⊣)to indicate negative regulations.

4. Use 1-3 sentences to explain what each of the following technologies is used for.

Two hybrid screen

DNA microarray

Enhancer trap

Transposon tag,

RNAi

5. Use 1-3 sentences to explain following terms:

Transposons

Ti-plasmid

Synteny

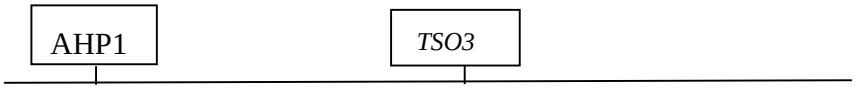
EST

YAC

Contig

6. Dr. Franks is mapped a gene named *TSO3* in *Arabidopsis*. He discovered that *TSO3* is linked to molecular marker *AHP1*. Specifically, *tso3* mutation was isolated in the Ler ecotype and was crossed into a Wild-type plant (Col ecotype). The F1 progeny of this cross is wild-type in phenotype but is heterozygous for *tso3* in genotype. He let the F1 plants self-cross and then isolated DNA from 15 *tso3* mutant plants in F2 generation. *AHP1* primers were used to PCR-amplify the *AHP1* locus from these 15 F2 individual *tso3* mutants. The PCR fragment was then digested with Hind III and then run on a 1% agarose gel. The following is the image from the gel after electrophoreses:

Ler	Col	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
___	___ ___	___	___	___	___	___	___	___	___	___	___ ___	___	___	___	___	___



a) Calculate the distance (in % recombination) between AHP1 and TSO3

b) Which chromosome of *Arabidopsis* is TSO3 located? (Hint: Use the Arabidopsis database (www.arabidopsis.org and then click on **map** - **search**) to find out which chromosome AHP1 resides).

c) If 1% recombination equals ~200 kb in physical distance, what is the physical distance between TSO3 and AHP1?

7. Mr. Wang has been studying a mutant named *lut2* that develops abnormal flowers and leaves. Using a map-based approach, he cloned this gene and obtained the cDNA sequence for LUT2. Please perform a **blast** search using this cDNA sequence (appendix A) and write in below what type of a protein does LUT2 encode.