GENOME371 EXAM 3A YELLOW KEY Autumn 2003

1A) (*4 points*) d. *CDC7* (wt) yeast cells
1B) (*4 points*) d. Shuttle plasmid with a yeast *ARS*, to be able to replicate as a free plasmid in yeast, and the *LEU2* gene, to be able to select for the presence of the plasmid in yeast cells.
1C) (*4 points*) d. *leu2 cdc7^{ts}* yeast
1D) (*4 points*) e. something else: - leucine plates at 37ºC
1E) (*4 points*) a. The plasmid does not integrate but remains as a free plasmid. Uncut it has three bands: supercoiled, relaxed circles and linear. Cut with EcoRI it has one band. Although the CDC7 clone has an insert, the probe only recognizes the vector band.
1F) (*4 points*) c. Compare the sequence of the insert with the sequence from the same fragment from *cdc7^{ts}* mutant cells and look for differences.

2A) (*2 points*) watson
2B) (*2 points*) The human gene has 4 exons and 3 introns.
2C) (*2 points*) The chimp gene has 3 exons and 2 introns.
2D) (*3 points*) The human and chimpanzee genes are homologous along most of their lengths, but the flanking DNA 5' and 3' differs.
2E) (*2 points*) crick.
2F) (*4 points*) human exon 2.
2G) (*3 points*) alternative splicing.

3A) (*3 points*) Yes. P.S.#1{32}, P.S.#2{100}, P.S.#3{7}
(*3 points*) Yes. P.S.#1{32}, P.S.#2{50 or 100}, P.S.#3{7}
(*3 points*) No. P.S.#2 (Anna has alleles 300 and 200, Clara has alleles 100 and 50).
3B) (*3 points*) Yes. If the pedigree on the left is correct and Grandma is the grandmother, Clara would have received PS1{32}, PS2{100} and PS3{7} from Miguel. Her mother must have provided Clara with her other alleles: PS1{34}, PS2{50} and PS3{1}. Mom could have received both PS1{34} and PS2{50} from Grandma. Although Grandma does not have PS3{1}, Clara's Mom could have received that allele from her father (Grandma's deceased husband, Clara's grandfather).
3C) (*4 points*) P[P.S.#1] = (.05)(.02)2 = .002
(You multiply by 2 since each allele could come from either parent.
P[P.S.#2] = (.01)(.01)2 = .0002
(These alleles are not homozygous – they just have the same frequency in the population.)
P[P.S.#3] = (.01)(.02)2 = .0004
Total probability = (.002)(.0002)(.0004) = 1.6×10^{-10}

4A) (*6 points*) No. You cannot tell which gametes that are inherited by the children are parental or recombinant.
4B) (*6 points*) Yes. Phase 1. Son III-2 received a recombinant gamete from his Dad.
4C) (*5 points*) 4) The loci may be linked at 40 cM but are definitely not closer together than 10 cM.

5A) (*1 point*) Any white colony.
5B) (*1 point*) β-Galactosidase (an enzyme that cleaves lactose, producing glucose and galactose; it also cleaves X-GAL, yielding a blue compound from a colorless one).
5B) (*2 points*) If a DNA fragment was inserted into the EcoRI site of the vector, the *lacZ* gene would be disrupted and the colonies would be white. If the plasmid does not contain an insert, the *lacZ* gene will encode a functional enzyme and the colonies will be blue.
5C) (*3 points*) a. 5' ACGTTATTCA 3' and 5' AAAGTTAAGC 3'
5D) (*1 point*) b. right
5E) (*4 points*) f. It cannot be determined from the data shown.
5F) (*3 points*) The right end of the original clone, which was used to make the probe, contains a repeated sequence that hybridizes to many sites in the genome.

6A) (*5 points*) The Y chromosome. Only males have red eyes. If the *P* element were on the X, only females (and all the females) would have red eyes. If the *P* element were on an autosome, equal numbers of males and females would have red eyes; equal numbers of males and females would also have white eyes.
6B) (*5 points*) No. The Jumpstarter transposase (which is encoded by a gene located on the Stubble-bearing chromosome) is not present to catalyze transposition.