OR072: Midterm Quiz Solutions

1.

polymerase

- *A.* matches mRNA codons to tRNA anticodons
- *B.* matches tRNA anticodons to amino acids
- [C.] makes a complementary copy of DNA or RNA
- *D.* algebraic expression for a genotype

intron

- *A.* area of DNA that has genetic material
- [B.] area of DNA that has no genetic material
- *C.* one of a pair of genes determining a particular trait
- *D.* computer chip manufacturer

Tjio&Levan

- [A.] discovered number of human chromosomes
- *B.* showed that DNA contains genetic information
- *C.* found gene for Huntington's disease
- *D.* world-renown juggling team

Linus Pauling

- [A.] established structure of proteins
- *B.* "Father of American Genetics"
- *C.* discovered first genetic disease
- *D.* found mapping from DNA triples to amino acids

Erwin Schrödinger

- *A.* head of laboratory where DNA was discovered
- [B.] famous physicist who asked "What is Life"
- *C.* invented the first computer
- *D.* determined the crystallographic structure of DNA

Oswald Avery

- *A.* established that proteins are responsible for bodily functions
- [B.] established that DNA contained hereditary properties
- *C.* discovered the structure of proteins
- *D.* discovered the structure of DNA

Myrna Gopnyk

- *A.* discovered first genetic disease
- *B.* established the genetic nature of Huntington's disease
- *C.* used X-ray crystallography to determine the structure of DNA
- [D.] established that grammar is hereditary

A rooted tree with at most 3 children per node can have *at most* ____ leaves of depth 3.

- *A.* 9
- *B.* 16
- [C.] 27
- *D.* 41

2. A. $(.40)(.40)\frac{1}{16}(n+n)(H+h)(n+n)(H+h)$
$+(.60)(.60)\frac{1}{16}(N+N)(H+h)(N+N)(H+h)$
$+2(.40)(.60)\frac{1}{16}(n+n)(H+h)(N+N)(H+h)$
$=.04nnHH+.08nnHh+.04nnhh+.09NNHH+.18NNHh$
$+.09NNhh+.12nNHH+.24nNHh+.12nNhh$

B. $(.90)(.80)(.40)(.60)\frac{1}{16}(n+n)(H+h)(N+N)(H+h)$
$=.0864nNHH+.1728nNHh+.0864nNhh$

C. $\frac{1}{4}(nn+Hh)(NN+Hh)=.25nnNN+.25nnHh+.25HhNN+.25HhHh$

D. $(.40)(.60)\frac{1}{16}(n+n)(H+h)(N+N)(H+h)$
$=.12nNHH+.24nNHh+.12nNhh$

E. $\frac{1}{16}(n+n)(H+h)(N+N)(H+h)=.25nNHH+.5nNHh+.25nNhh$

F. $.04(1)(1)+.08(1)(1)+.04(1)(.9)+.09(.8)(1)+.18(.8)(1)+.09(.8)(.9)+.12(.8)(1)+.24(.8)(1)+$
$.12(.8)(.9)$
$=.04+.08+.036+.072+.144+.0648+.096+.192+.0864=.8112$

A particular species of bird has two pairs of traits, nearsightedness(N)/farsightedness(n), and hard-shelled(H)/soft-shelled(h) eggs, with N and H the dominant traits.

(a) Suppose a pure far-sighted, half hard-shelled bird ($nnHh$) mated with a pure nearsighted, half hard-shelled bird ($NNHh$). What would be the percentage of nearsighted soft-shelled offspring in the following generation?

Expression E: Coefficient of $nNhh$ term = 25%

(b) Suppose you have a population of these two species with 40% $nnHh$ and 60% $NNHh$. Now what would be the percentage of nearsighted soft-shelled offspring in the following generation?

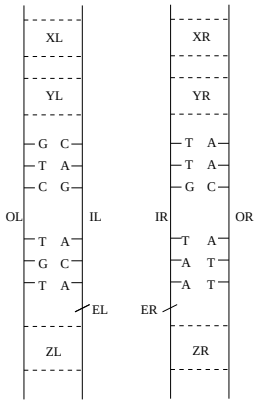
Expression A: Add coefficients of $NNhh$ and $nNhh$ terms = .09 + .12 = 21%

(c) Finally, suppose that 10% of all soft-shelled eggs are destroyed before they hatch, and that 20% of all hatched nearsighted birds are killed before they mate? (Assume that eggs/birds are not destroyed by any other means.) Starting with the mating-age population given in (b), what would be the percentage nearsighted soft-shelled offspring reaching mating age in the following generation?

Expression F: Add terms corresponding to $NNhh$ and $nNhh$, and then divide by the sum of all the terms

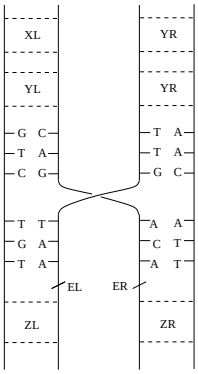
$$\frac{.0648+.0864}{.8112}=18.64\%.$$

3. The initial picture:



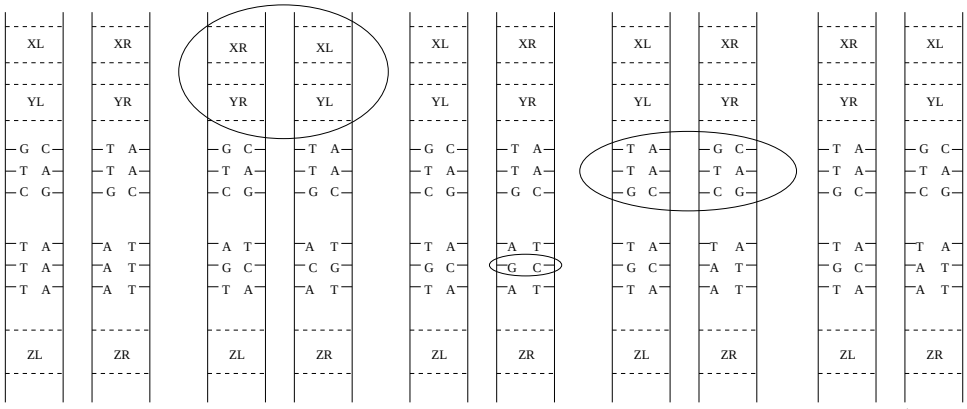
(i)

(a) Draw a picture of the situation after the crossing occurs.



(i)

(b) Which of the following pairs could be valid results of a crossing between these pairs? If the pair is invalid, *circle the parts that are wrong.*



(c) *How many* possible results of a crossing of these chromatids can there be?

There are 4 mismatched pairs, and two ways of cutting the strands, for a total of $2 \times 2 \times 2 \times 2 \times 2 = 32$ possible results of the crossing.