MBG 2400-Fall 2016
Practice Midterm Multiple Choice Questions
For Micallef's Material

Note that the answers are provided at the end of the document. These questions reflect the questions that will be found in B. Micallef's section of the Midterm. There will be ~25 questions, each worth 1 mark, on B. Micallef's material on the Midterm. There will be a similar number of points on E. Lee's section of the Midterm. It is suggested that you first try to answer the questions and then look at the answers at the end of this document. If you find there are areas where you are weaker, go back and study that material more and possibly go to a study session if necessary.

(1) During which phase of meiosis do Mendel's 1st and 2nd Principles of Inheritance occur?
(a) metaphase I (b) anaphase I (c) anaphase II (d) interphase I

(2) Which of the following is <u>not</u> true regarding mitosis and meiosis?
(a) Recombination is more frequent in meiosis than mitosis.
(b) There is a complete replication of all nuclear chromosomes in both processes.
(c) There is one cell division in mitosis and two cell divisions in meiosis.
(d) In both mitosis and meiosis the resulting cells can be either n or 2n.

(3) For which of the following genotypes in a pea plant will Mendel's 1st Principle of Inheritance (Principle of Segregation) be observed by examining the progeny resulting from <u>self pollination</u> of that genotype? Assume that each of alleles A, B, and C show dominant intra-allelic gene action.
(a) AABBCC (b) AaBBCC (c) aaBBCC (d) aabbcc (e) none of a, b, c or d

-want all dominant
-want some variability

(4) What do the three principle life cycles in eukaryotes all have in common?
(a) Mitosis occurs in both the n and 2n phases of the life cycle.
(b) All of these life cycles produce spores.
(c) They all produce a zygote in the life cycle.
(d) There is a multicellular stage in both the n and 2n phases
(e) More than one answer for a, b, c, and d is true.

(5) Which of the following basic components in the plant life cycle are not produced specifically in flowering plants?
(a) antheridia (b) archegonia (c) megasporangium (d) gametes

(6) In flowering plants, the alternation of generations is:
(a) both isomorphic and heterosporous.
(b) both heteromorphic and heterosporous.
(c) both isomorphic and homosporous.
(d) both heteromorphic and homosporous.

(7) In an animal showing automictic parthenogenesis, what will be the possible genotype(s) of the progeny if the mother has the genotype Aa?
(a) Aa (b) AA (c) aa (d) AA and aa

(8) Automixis in plants is most analogous to which of the following modes of reproduction in animals?
(a) Vegetative asexual reproduction.
(b) Apomictic parthenogenesis.
(c) Automictic parthenogenesis.
(d) Amphimixis.

(9) In the plant apomictic (i.e. asexual seed production) breeding systems discussed in class:
(a) both meiosis and fertilization are bypassed in all cases. ×
(b) meiosis is bypassed in all cases.
(c) fertilization is bypassed in all cases.
(d) none of the above are true. ×

(10) Assume that a bird showing the ZZ-ZW sex determination system has a sex-linked gene that controls eye colour, such that the dominant A allele causes red eyes and the recessive a allele causes blue eye, and that males only show blue eyes and females only show red eyes. Assume that recombination does not occur between the Z and W chromosomes. Based on this information, which of the following is true?
(a) The Z chromosome only carries the a allele.
(b) The Z chromosome can carry the A allele.
(c) The W chromosome only carries the a allele.

(11) In the dioecious plant asparagus, the M-locus is found on XY sex chromosomes, and 2 very tightly-linked genes are found within the M-locus. These two genes include the F gene that controls female fertility, and the Ms gene that controls male fertility. The following phenotypes and genotypes are associated with each allele:
F = dominant female sterile allele;
f = recessive female fertile allele;
Ms = dominant male fertile allele;
ms = recessive male sterile allele.
tightly linked
- dominant/recessive are attached in coupling
What is the genotype of the XY male (genotype for the M-locus = Mm) assuming that the recessive alleles for both genes are in coupling phase?
(a) Ff MsMs (b) ff msms (c) FF MsMs (d) Ff Msms
want dominant/recessive together
not female

(12) Gregor Mendel described two basic laws of inheritance. According to Mendel's 2nd Law of Independent Assortment
(a) the transmission of one gene has no influence over the transmission of another gene. ×
(b) the alleles of a gene are always distributed into separate gametes.
(c) the dominant allele will always mask the expression of the recessive allele of the same gene.
(d) the segregation of one gene is independent of the assortment of another gene.

-true breeding = homozygous

(13) Pea plants that are true-breeding for yellow, smooth seeds:
(a) must be homozygous for the genes controlling those traits.
(b) could have the genotypes *GgWw*, *GGWw*, and *GgWW*.
(c) will not produce true-breeding progeny when selfed.
(d) are dihybrids.

(14) An angiosperm sporophyte cell has a genotype of *AABbCc*. Gene *A* is on chromosome 1, gene *B* on chromosome 2, and gene *C* on chromosome 3. What is the probability that this sporophyte will produce *ABC* gametes assuming independent assortment of genes?
(a) 1/8
(b) 27/64
(c) 1/4
(d) 1/2
(e) 1

(15) The above dihybrid in (14) is self-fertilized. What is the probability that it will produce offspring that are genotypically *AaBbCc*?
(a) 1/8
(b) 27/64
(c) 1/4
(d) 1/2
(e) 0

(16) The dominant allele *B* produces black coat colour in dogs. Dogs that are homozygous recessive, *bb*, are brown. Curly hair in dogs is controlled by a dominant allele *C* and dogs that are homozygous recessive, *cc*, have straight hair. A true breeding brown straight haired dog is test-crossed. What are the phenotypic proportions expected in the progeny assuming independent assortment of genes?
bbcc × bbcc
test cross = homozygous recessive
(a) ½ curly and brown : ½ curly and black
(b) All black and curly
(c) ¼ curly and black : ¼ curly and brown : ¼ straight and black : ¼ straight and brown
(d) All brown and straight haired

In *Drosophila*, the allele for black body, *b*, is recessive to the allele for grey (normal body colour). The allele for vestigial wings, *vg*, is recessive to that of normal wings. A dihybrid female fly is test-crossed. The number and phenotype of the offspring are indicated in the table below.

b = black
B = grey
vg = vestigial
VG = normal

Phenotypes	Number
grey-bodied, normal wings	28
grey-bodied, vestigial wings	130
black-bodied, normal wings	142
black-bodied, vestigial wings	24

Use the above information to answer the following 2 questions.

Bb

(17) Do these data agree with the hypothesis that the genes are independently assorting?
(a) Yes; it fits the expected 9:3:3:1 ratio
(b) No; it does not fit the expected 9:3:3:1 ratio
(c) Yes; it fits the expected 1:1:1:1 ratio
(d) No; it does not fit the expected 1:1:1:1 ratio
(e) Yes; it fits the expected 1:2:2:1 ratio

(18) The Chi square value using the above data is:
(a) 150
(b) 106
(c) 81
(d) 324
(e) None of the above
Note: I will not ask you to calculate the Chi square value from scratch on the Midterm.

Coat colour and texture in dogs is controlled by many genes. The dominant allele, *B*, determines black pigmentation in the coat, and recessive allele, *b*, determines brown. Homozygous, *ss*, individuals have white spotting. Individuals with the genotype *S*- lack white spotting. Coat texture is controlled by another gene, with the dominant allele, *W*, producing wire hair and the recessive allele, *w*, producing smooth hair. True-breeding solid black, smooth-coated dogs are crossed to true-breeding brown, white-spotted, wire-haired dogs. The resulting F1 progeny are crossed to produce 100 F2 puppies. Use this information to answer questions 19 & 20..

(19) Approximately how many F2 puppies will be black with white spots and have a wire-haired coats?
(a) 2
(b) 5
(c) 14
(d) 4
(e) None of the above

(20) What proportion of the F2 will be *BbSSWW*?
(a) 1/16
(b) 1/32
(c) 1/64
(d) 1/8
(e) None of the above

(21) The palomino horse is a hybrid, D^1D^2, exhibiting a golden body colour and a lighter mane and tail. Horses homozygous for the D^1 allele are chestnut/sorrel while the phenotype produced by the D^2 homozygotes is cremello (cream colour). From matings between palominos, what proportion of progeny will have the chestnut/sorrel phenotype?
(a) 1/3
(b) 1/4
(c) 1/2
(d) 2/3
(e) None of the above

epistasis)

The white Leghorn breed of chickens is homozygous for the dominant allele *C*, which produces colored feathers. However, this breed is also homozygous for the dominant allele *I* of an independently assorting gene that inhibits coloration of the feathers. Consequently, Leghorn chickens have white feathers. The white Wyandotte breed of chickens has neither the allele for color nor the inhibitor of color; it is therefore genotypically *cc ii.* Use this information to answer questions 22 & 23.

(22) What are the F_2 phenotypes and proportions expected from intercrossing the progeny of a white Leghorn hen and a white Wyandotte rooster?
(a) ¾ coloured: ¼ white
(b) 13/16 white; 3/16 coloured;
(c) 9/16 coloured; 7/19 white
(d) ¾ white; ¼ coloured

CCII x ccii
$F_1 \rightarrow$ CcIi x CcIi
-big punnet square

(23) What are the phenotypes and proportions expected if the dihybrid CcIi is testcrossed?
(a) ¾ white; ¼ coloured
(b) 1 white; 1 coloured
(c) ¾ coloured; ¼ white

CcIi x ccii
¼ coloured
¾ white

In *Drosophila*, the allele for hairy body, *h,* is recessive to the allele for normal hairless body, *H* the allele for purple eyes, *p*, is recessive to that of normal brown eyes, *P*. A dihybrid female is crossed to a purple-eyed, hairy male, and the following progeny are obtained:

Phenotypes	Number
wildtype - dominant	91
normal body, purple eyes	9
hairy body, purple eyes recessive	89
hairy body, normal eyes	11

- cannot be 50+ map units apart

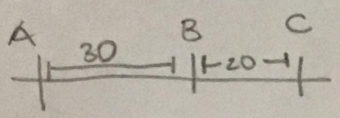
Use this information to answer questions 24 & 25 below.

(24) What is the distance (in map units) between loci assuming the genes are linked?
(a) 5.5
(b) 4.5
(c) 10
(d) 20

91 - 89 = 10

(25) Consider the cross *DdEeFf* and *ddeeff*. If genes *D* and *E* are very tightly linked (do not recombine) and *F* is independently assorting, how many phenotypic classes of progeny will there be?
(a) 4
(b) 8
(c) 2
(d) 6
(e) 1

D + E are linked ∴ always together
D_E_F
D_E_f
ddeeFf
ddeeff



(26) Three linked genes are found in the order A-B-C on a chromosome. The map distance between genes A and B is 30 cM and the map distance between genes B and C is 20 cM. What will be the recombination frequency between genes A and C? 30 cM + 20 cM = 50

(a) 10% (b) 20% (c) 30% (d) 50%

(27) In certain economically important crops (for example maize) it is necessary to prevent self-pollination, which interferes with the production of hybrid seed. Male-sterile plants produce no functional pollen and therefore self pollination is avoided. A form of male sterility in maize is determined by an extranuclear gene, *Ms*. Plants of a male-sterile line that are pollinated with normal pollen give rise to sterile-male plants. Some varieties of maize carry an autosomal dominant, nuclear gene, *Rf*. The gene *Rf* restores pollen fertility in male-sterile lines. (Normal cytoplasm is designated *[N]* and male-sterile cytoplasm is designated *[Ms]*). Use this information to answer questions 17 and 18.

If *[Ms] Rf Rf* plant is pollinated with pollen from a *[N] rf rf* plant, what are the results?

(a) 1/2 plants are male-sterile and 1/2 plants are male-fertile
(b) all plants are male-sterile
(c) all plants are male-fertile
(d) 3/4 plants are male-sterile and 1/4 plants are male-fertile

(28) What is an allopolyploid?

(a) Polyploids created by chromosome duplication within a species
(b) A gamete formed by unreduced chromosomes during meiosis
(c) When a trivalent is pulled apart during meiosis
(d) Polyploids created by hybridization between different species

Answers:

1. b;
2. d;
3. b;
4. c;
5. b;
6. b;
7. d;
8. c;
9. c;
10. a;
11. d;
12. d;
13. a;
14. c;
15. e;
16. d;
17. d;
18. a;

19. c;
20. b;
21. b;
22. b;
23. a;
24. c;
25. a;
26. d.
27. c
28. d