LOGIC

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{ Overview }

The foundation of the Aristotelian square of opposition is the logic of classes. A class is defined as a group of objects that have some recognizable common characteristic. Every categorical statement either affirms that the subject term is related to the predicate term, or else it denies that the subject term is related to the predicate term. The four standard-form categorical statements are:

*A***:** All S are P. This is a universal affirmative statement, which asserts that all members of the subject term are members of the predicate term.

E: No S are P. This is a universal negative statement, which asserts that no members of the subject term are members of the predicate term.

I: Some S are P. This is a particular affirmative statement, which asserts that some members of the subject term are members of the predicate term.

O: Some S are not P. This is a particular negative statement, which asserts that some members of the subject term are not members of the predicate term.

The terms "universal" and "particular" refer to the quantity of a categorical statement; the terms "affirmative" and "negative" refer to its quality. The terms "all," "no," and "some," are called quantifiers; they tell us the extent of the class inclusion or exclusion. The quantifier refers specifically and exclusively to the subject term.

If a categorical statement says something definite about every member of the class designated by a term, then the term is said to be distributed.

Opposition occurs when two standard-form categorical statements have the same subject and predicate terms, but differ in quality, quantity, or both.
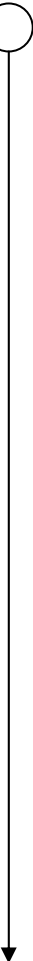
Contradictories are pairs of statements in which one is the negation of the other (*A* and *O* statements are contradictories, as are *E* and *I* statements).

Contraries are pairs of statements that cannot both be true at the same time, but can both be false at the same time (*A* and *E* statements are contraries).

Subcontraries are pairs of statements that cannot both be false at the same time, but can both be true; also, if one is false then the other must be true (*I* and *O* statements are subcontraries).

Subalternation is the relationship between a universal statement and its corresponding particular statement (if the universal statement of a pair is true, then its corresponding particular partner will also be true).

An immediate inference is an inference that has only one premise. A conversion is an immediate inference created by interchanging the subject and predicate terms. An obversion is an immediate inference formed by changing the quality of the given statement, and then replacing the predicate term with its complement. The complement is defined as the set of objects that do not belong to a given class. Contraposition, a third type of immediate inference, is formed by replacing the subject term of a given statement with the complement of its predicate term and then replacing the predicate term of the given statement with the complement of its subject term.

A statement has **existential import** if it asserts or presupposes the existence of certain kinds of objects. According to the Aristotelian square of opposition**,** particular statements follow validly from their corresponding universal statements by subalternation. This means that the universal statements must have existential import, because a statement with existential import cannot be derived from one that does not have it. However, if all *A* statements have existential import, then some contradictory *A* statements and *O* statements can be false at the same time. The solution to this problem came from the work of George Boole and John Venn. Their ideas were used to create what has come to be known as the *Boolean square of opposition*.

Venn diagrams are used to represent classes. Since categorical statements contain two classes, the classes are represented by two intersecting circles. The drawing is then annotated, depending on the claim made by that statement. If a class is empty, then the circle is completely shaded to indicate that it has no members. If it is claimed that there is at least one member, then an *X* is placed inside the circle. The pictures are meant to represent the logical commitments of categorical statements and categorical inferences. A complete diagram of a categorical inference reveals whether the conclusion must be true (valid inference), or whether there is a possibility of a false conclusion (invalid inference).

A categorical syllogism is an inference constructed entirely of categorical statements. Every standard-form categorical syllogism contains exactly three terms, each of which is used two times. The subject of the conclusion is the minor term, the predicate of the conclusion is the major term, and the term that occurs only in the premises is the middle term. The first premise contains the major term and is called the major premise. The second premise contains the minor term and is called the minor premise.

Since categorical syllogisms have three terms, we can use three circles to diagram them. We start by drawing the information given in the first premise as if it were true. The next step is to add to the diagram by drawing the information in the second premise, again as if it were true. The diagram is complete when it includes all the information given in the two premises. To decide whether the inference is valid or invalid we check to see if the conclusion must be true.

In constructing (or reconstructing) standard-form categorical syllogisms the order of the premises and conclusion are labeled by the type of categorical statements involved. This ordering and labeling determines the mood of the categorical syllogism. The middle term can be arranged in the two premises in four different ways. These placements determine the figure of the categorical syllogism.

There are six rules and fallacies associated with standard-form categorical syllogisms: 1. A negative premise cannot have an affirmative conclusion. 2. A negative conclusion cannot have all affirmative premises. 3. A syllogism cannot have two negative premises 4. Two universal premises cannot have a particular conclusion. 5. Any term that is distributed in the conclusion must be distributed in the premises. 6. The middle term must be distributed in at least one premise.

Solutions and Explanations for *Exercise Sets*

Exercise Set -- A2.1

1. Subject term: *senior citizen*
    Predicate term: *eligible for subsidized drug prescriptions*
    This is an example of an *A* statement.

2. Subject term: *public schools*
    Predicate term: *meeting national standards for excellence*
    This is an example of an *O* statement.

3. Subject term: *families*
    Predicate term: *below the poverty line*
    This is an example of an *I* statement.

4. Subject term: *national health care plan*
    Predicate term: *needed*
    This is an example of an *E* statement.

5. Subject term: *malicious murderers*
    Predicate term: *evil people*
    This is an example of an *A* statement.

6. Subject term: *X-rated movies*
    Predicate term: *intellectually stimulating*
    This is an example of an *A* statement.

7. Subject term: *video games*
    Predicate term: *violent*
    This is an example of an *O* statement.

8. Subject term: *petty bureaucrats*
    Predicate term: *tyrannical*
    This is an example of an *I* statement.

9. Subject term: *lottery winners*
    Predicate term: *lucky*
    This is an example of an *E* statement.

10. Subject term: *diet fads*
    Predicate term: *healthy*
    This is an example of an *O* statement.

11. Subject term: *sporting events*
    Predicate term: *television shows worth watching*
    This is an example of an *A* statement.

12. Subject term: *philosophy books*
    Predicate term: *important contributions to literature*
    This is an example of an *I* statement.

13. Subject term: *amendments to the U.S. Constitution*
    Predicate term: *unconstitutional*
This is an example of an *E* statement.

14. Subject term: *gamblers*
    Predicate term: *superstitious people*
This is an example of an *A* statement.

15. Subject term: *psychics*
    Predicate term: *frauds*
This is an example of an *I* statement.

Exercise Set -- A2.2

1. Universal Affirmative; Subject Term distributed; Predicate Term undistributed.
2. Particular Negative; Subject Term undistributed; Predicate Term distributed.
3. Universal Negative; Subject Term distributed; Predicate Term distributed.
4. Particular Affirmative; Subject Term undistributed; Predicate Term undistributed.
5. Universal Negative; Subject Term distributed; Predicate Term distributed.
6. Universal Negative; Subject Term distributed; Predicate Term distributed.
7. Particular Affirmative; Subject Term undistributed; Predicate Term undistributed.
8. Particular Negative; Subject Term undistributed; Predicate Term distributed.
9. Universal Affirmative; Subject Term distributed; Predicate Term undistributed.
10. Universal Negative; Subject Term distributed; Predicate Term distributed.
11. Universal Affirmative; Subject Term distributed; Predicate Term undistributed.
12. Particular Negative; Subject Term undistributed; Predicate Term distributed.
13. Universal Negative; Subject Term distributed; Predicate Term distributed.
14. Particular Affirmative; Subject Term undistributed; Predicate Term undistributed.
15. Universal Negative; Subject Term distributed; Predicate Term distributed.

Exercise Set -- A2.3

1. "b" is the correct answer.
Since the first sentence is an *E* statement, its contradictory must be an *I* statement, which is answer "b." The correct answer cannot be "a" because it is an *A* statement (the *contrary* of *E*); "c" is not correct because it is an *O* statement.

2. Yes.
A statements and *E* statements are *contraries*.

3. Yes.
I statements and *O* statements are *subcontraries*.

4. "b." False.
The first is an *I* statement, and if it is true, its contradictory *E* statement must be false.

5. "a." True.
The first is an *I* statement, and if it is false, its contradictory *E* statement must be true.

6. False.
If they are contradictories, then one must be true and the other must be false.

7. "b." False.
Since these fall under *subalternation,* if the particular (in this case an *I* statement) is false, then the corresponding universal (in this case an *A* statement) must be false, too.

8. "c." Undetermined.
Since these fall under *subalternation,* if the particular (in this case an *I* statement) is true, then the corresponding universal (in this case an *A* statement) could be either true or false.

9. "a." True.
Since these fall under *subalternation,* if the universal (in this case an *E* statement) is true, then the corresponding particular (in this case an *O* statement) must be true, too.

10. "c." Undetermined.
Since these fall under *subalternation,* if the universal (in this case an *E* statement) is false, then the corresponding particular (in this case an *O* statement) could be either true or false.

11. "Some sports cars are not gas-guzzlers."
Since the first sentence is an *A* statement, its contradictory must be an *O* statement.

12. "No diamond rings are expensive."
 Only *A* statements and *E* statements are contraries.

13. There is no relationship of opposition between these statements. Both are *I* statements. They have the same subject term, but different predicate terms.

14. The second statement is the contradictory of the first; so, it must be false, if the first is true.

15. Undetermined. No immediate inference can be made about the subaltern of a false *A* statement.

16. b. False
Since they are *contraries,* they cannot both be true at the same time.

17. a. True
Since these fall under *subalternation,* if the universal is true, then the corresponding particular must be true.

18. b. False
Since they are *contradictories*, if one is true, then the other must be false.

19. c. Undetermined
Since they are *contraries,* they can both be false at the same time.

20. c. Undetermined
Since these fall under *subalternation,* if the universal is false, then the corresponding particular could be either true or false.

21. a. True
Since they are *contradictories*, if one is false, then the other must be true.

22. b. False
Since they are *contraries,* they cannot both be true at the same time.

23. b. False
Since they are *contradictories*, if one is true, then the other must be false.

24. a. True
Since these fall under *subalternation,* if the universal is true, then the corresponding particular must be true.

25. c. Undetermined
Since they are *contraries,* they can both be false at the same time.

26. a. True
Since they are *contradictories*, if one is false, then the other must be true.

27. c. Undetermined
Since these fall under *subalternation,* if the universal is false, then the corresponding particular could be either true or false.

28. c. Undetermined
Since these fall under *subalternation,* if the particular is true, then the corresponding universal could be either true or false.

29. b. False
Since they are *contradictories*, if one is true, then the other must be false.

30. c. Undetermined
Since they are *subcontraries* they can both be true at the same time.

31. b. False
Since these fall under *subalternation,* if the particular is false, then the corresponding universal must be false.

32. a. True
Since they are *contradictories*, if one is false, then the other must be true.

33. a. True
Since they are *subcontraries,* they cannot both be false at the same time.

34. b. False
Since they are *contradictories*, if one is true, then the other must be false.

35. c. Undetermined
Since these fall under *subalternation,* if the particular is true, then the corresponding universal could be either true or false.

36. c. Undetermined
Since they are *subcontraries,* they can both be true at the same time.

37. a. True
Since they are *contradictories*, if one is false, then the other must be true.

38. b. False
Since these fall under *subalternation,* if the particular is false, then the corresponding universal must be false.

39. a. True
Since they are *subcontraries,* they cannot both be false at the same time.

Exercise Set -- A2.4

1. *Converse*: Some sucker bets are games of chance.
2. *Obverse*: Some games of chance are not nonsucker bets.
3. *Contrapositive*: Not valid for *I* statements.
4. *Converse*: Not valid for *O* statements.
5. *Obverse*: Some sandwiches are nonthings made with meat.
6. *Contrapositive*: Some nonthings made with meat are not nonsandwiches.
7. *Converse*: No vegetarians are bats.
8. *Obverse*: All bats are nonvegetarians.
9. *Contrapositive*: Some nonvegetarians are not nonbats. (*Valid by limitation*)
10. *Converse*: Some genetically engineered objects are designer jeans. (*Valid by limitation*)
11. *Obverse*: No designer jeans are nongenetically engineered objects.
12. *Contrapositive*: All nongenetically engineered objects are nondesigner jeans.
13. *Converse*: No people likely to go to prison are greedy politicians.
14. *Obverse*: All greedy politicians are nonpeople likely to go to prison.
15. *Contrapositive*: Some nonpeople likely to go to prison are not nongreedy politicians. (*Valid by limitation)*
16. *Converse*: Not valid for *O* statements.
17. *Obverse*: Some fruitcakes are nonregifted presents.
18. *Contrapositive*: Some nonregifted presents are not nonfruitcakes.
19. *Converse*: Some social deviants are embezzlers. (*Valid by limitation*)
20. *Obverse*: No embezzlers are nonsocial deviants.
21. *Contrapositive*: All nonsocial deviants are nonembezzlers.
22. *Converse*: Some incidents caused by speeding are traffic accidents.
23. *Obverse*: Some traffic accidents are not nonincidents caused by speeding.
24. *Contrapositive*: Not valid for *I* statements.
25. *Converse*: Some days when banks close are public holidays. (*Valid by limitation*)
26. *Obverse*: No public holidays are nondays when banks close.
27. *Contrapositive*: All nondays when banks close are nonpublic holidays.
28. *Converse*: Not valid for *O* statements.
29. *Obverse*: Some music videos are nontragedies.
30. *Contrapositive*: Some nontragedies are not nonmusic videos.
31. *Converse*: Some juicy items are T-bone steaks.
32. *Obverse*: Some T-bone steaks are not nonjuicy items.
33. *Contrapositive*: Not valid for *I* statements.
34. *Converse*: Some mouth-watering morsels are fajitas.
35. *Obverse*: Some fajitas are not nonmouth-watering morsels.
36. *Contrapositive*: Not valid for *I* statements.
37. *Converse*: No things harmful to your diet are ice cream toppings.
38. *Obverse*: All ice cream toppings are nonthings harmful to your diet.
39. *Contrapositive*: Some nonthings harmful to your diet are not nonice cream toppings. (*Valid by limitation*)
40. *Converse*: Some healthy foods are yogurt products. (*Valid by limitation*)
41. *Obverse*: No yogurt products are nonhealthy foods.
42. *Contrapositive*: All nonhealthy foods are nonyogurt products.
43. *Converse*: No things lacking in multiple vitamins are vegetables.
44. *Obverse*: All vegetables are nonthings lacking in multiple vitamins.
45. *Contrapositive*: Some nonthings lacking in multiple vitamins are not nonvegetables. (*Valid by limitation*)
46. *Converse*: Some things too hot to eat are barbeque wings.
47. *Obverse*: Some barbeque wings are not nonthings too hot to eat.
48. *Contrapositive*: Not valid for *I* statements.
49. *Converse*: Some grease-laden products are french fries. (*Valid by limitation*)
50. *Obverse*: No french fries are nongrease-laden products.
51. *Contrapositive*: All nongrease-laden products are nonfrench fries.

52.   *Converse*: Some sugar-free products are cheese-cakes.
53.   *Obverse*: Some cheese-cakes are not nonsugar-free products.
54.   *Contrapositive*: Not valid for *I* statements.
55.   *Converse*: Some foods best eaten when ripe are bananas. (*Valid by limitation*)
56.   *Obverse*: No bananas are nonfoods best eaten when ripe.
57.   *Contrapositive*: All nonfoods best eaten when ripe are nonbananas.
58.   *Converse*: Some items delicious to eat are tofu products.
59.   *Obverse*: Some tofu products are not nonitems delicious to eat.
60.   *Contrapositive*: Not valid for *I* statements.
61.   *Converse:* Some great works of art are tattoos.
62.   *Obverse*: Some tattoos are not nongreat works of art.
63.   *Contrapositive*: Not valid for *I* statements.
64.   *Converse*: Not valid for *O* statements.
65.   *Obverse*: Some modern clothes are nonwarm garments.
66.   *Contrapositive*: Some nonwarm garments are not nonmodern clothes.
67.   *Converse*: No easy to clean objects are swimming pools.
68.   *Obverse*: All swimming pools are noneasy to clean objects.
69.   *Contrapositive*: Some noneasy to clean objects are not nonswimming pools. (*By limitation*)
70.   *Converse*: Some artificially sweetened products are movie theater drinks. (*By limitation*)
71.   *Obverse*: No movie theater drinks are nonartificially sweetened products.
72.   *Contrapositive*: All nonartificially sweetened products are nonmovie theater drinks.
73.   *Converse*: No acts left unrewarded are good deeds.
74.   *Obverse*: All good deeds are nonacts left unrewarded.
75.   *Contrapositive*: Some nonacts left unrewarded are not nongood deeds. (*By limitation*)

Exercise Set -- A2.7

1.   S = "snowmen," P = "permanent lawn fixtures"
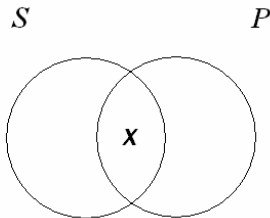
2.   S = "leeches," P = "lawyers"
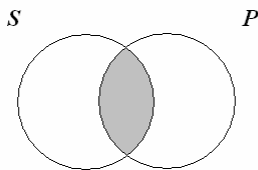
3.   S = "television newscasters," P = "good actors"
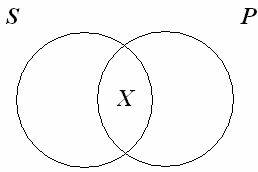
4.   S = "donuts," P = "lean cuisine"
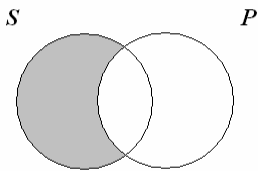
5.   S = "psychics," P = "frauds"
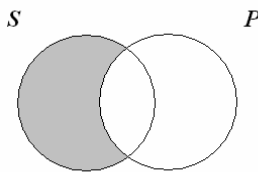
6.   S = "children," P = "following in their parents footsteps"
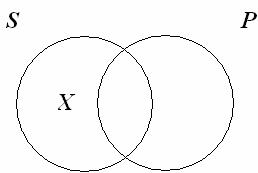
7.   S = "volcanos," P = "currently active geologic structures"
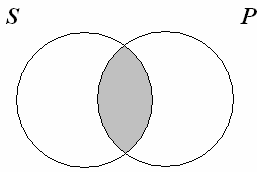
8.   S = "ducks," P = "daffy creatures"
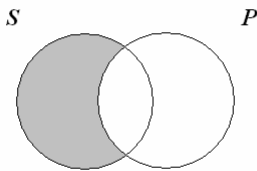
9.   S = "teachers," P = "miserable wretches"
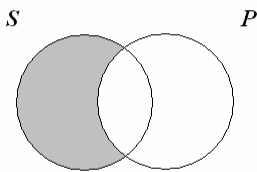
10. S = "poems," P = "beautifully written works of literature"
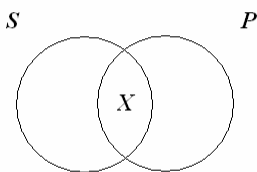
11. S = "viruses," P = "lethal to humans"
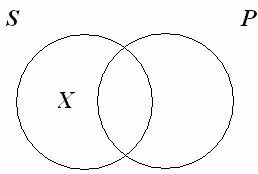
12. S = "Nobel Laureates," P = "Olympic champions"
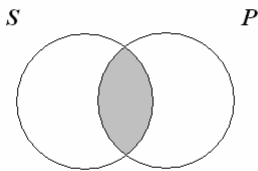
13. S = "sea creatures," P = "bivalves"
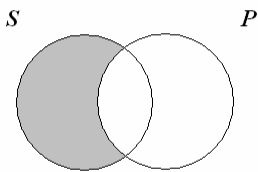
14. S = "rock stars," P = "good parents"
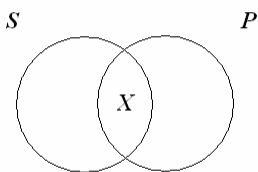
15. S = "condiments," P = "free"
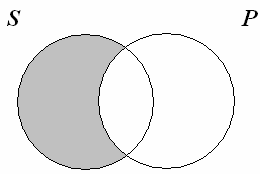
16. S = "exotic vegetables," P = "edible"
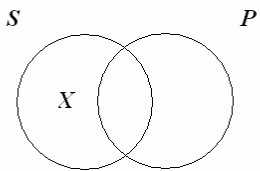
17. S = "scientific research," P = "fraudulent"
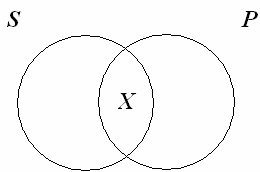
18. S = "television commercials," P = "worthy of our attention"
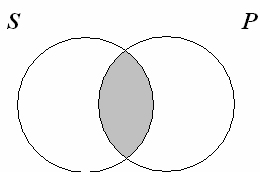
19. S = "finely tuned instruments," P = "soothing to the ear"
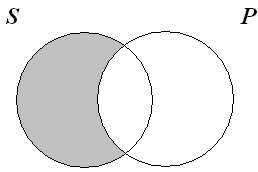
20. S = "floppy disks," P = "defective"
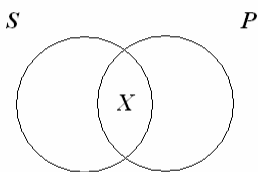
21. S = "French pastries," P = "good for your complexion"
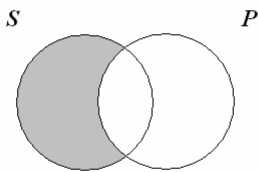
22. S = "cows," P = "flatulent"
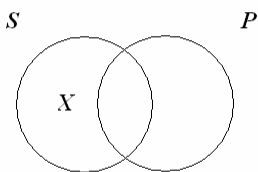
23. S = "Nobel Prize winners," P = "illiterate"
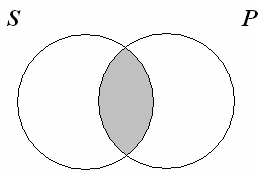
24. S = "swimmers," P = "healthy people"
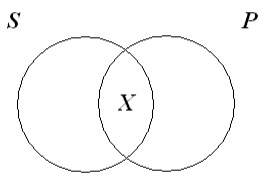
25. S = "dogs," P = "faithful pets"
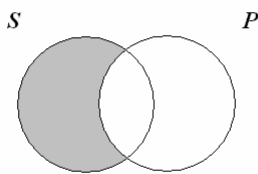
26. S = "spiders," P = "nocturnal creatures"
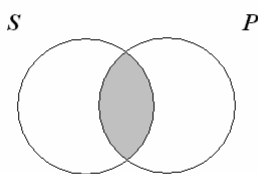
27. S = "race car drivers," P = "fearless competitors"
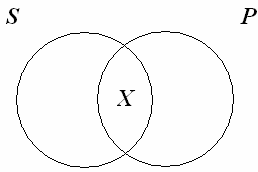
28. S = "college textbooks," P = "works of art"
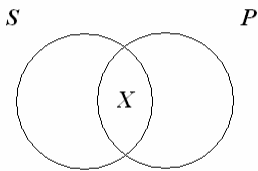
29. S = "teachers," P = "inspired"
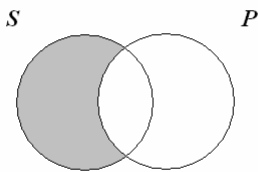
30. S = "games of chance," P = "sucker bets"
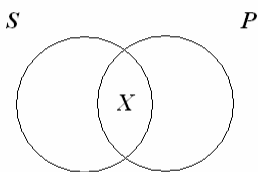
31. S = "sandwiches," P = "things made with meat"
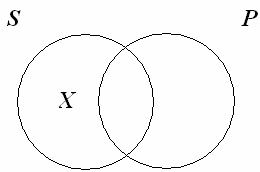
32. S = "bats," P = "vegetarians"
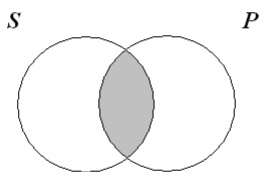
33. S = "designer jeans," P = "genetically engineered objects"
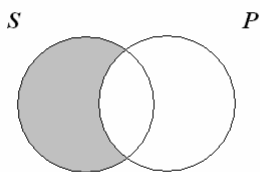
34. S = "greedy politicians," P = "people likely to go to prison"
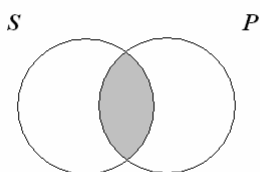
35. S = "fruitcakes," P = "regifted presents"
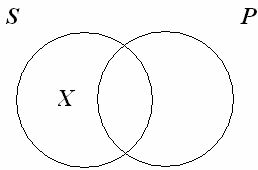
36. S = "embezzlers," P = "social deviants"
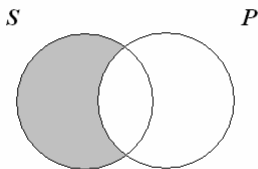
37. S = "traffic accidents," P = "incidents caused by speeding"
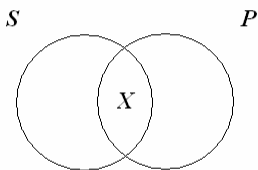
38. S = "public holidays," P = "days when banks close"
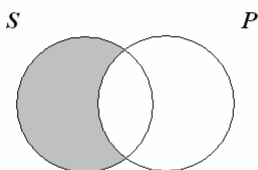
39. S = "music videos," P = "tragedies"
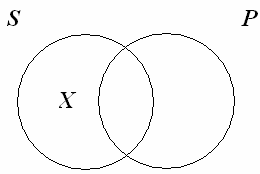
40. S = "fajitas," P = "mouth-watering morsels"
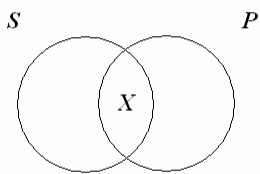
41. S = "ice cream toppings," P = "harmful to your diet"
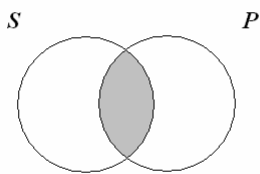
42. S = "yogurt products," P = "healthy"
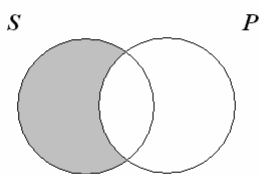
43. S = "vegetables," P = "lacking in multiple vitamins"
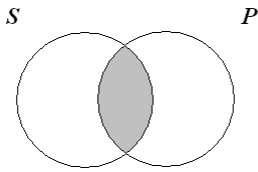
44. S = "barbeque wings," P = "too hot to eat"
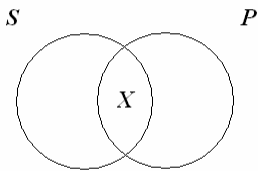
45. S = "french fries," P = "grease-laden"
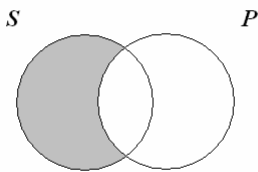
Exercise Set -- A2.9

1. All *M* are *P*
    <u>Some *M* are *S*</u>
    Some *S* are *P*
Answer: This is a valid inference.
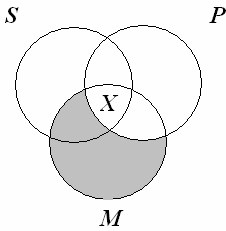
2. No *M* are *P*
    <u>Some *S* are not *M*</u>
    Some *S* are not *P*
Answer: This is an invalid inference.
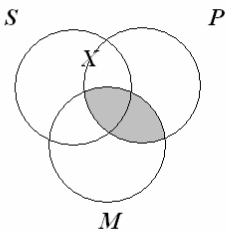
3. All *P* are *M*
    <u>All *S* are *M*</u>
    All *S* are *P*
Answer: This is an invalid inference.
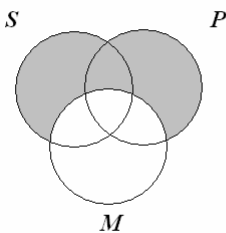
4. Some *P* are *M*
   Some *S* are *M*
   Some *S* are *P*

Answer: This is an invalid inference.
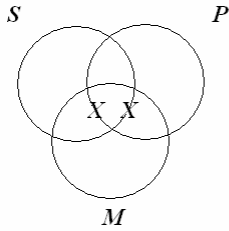
5. Some *M* are not *P*
   Some *M* are not *S*
   Some *S* are not *P*

Answer: This is an invalid inference.
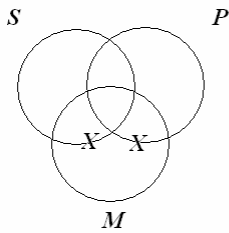
6. No *P* are *M*
   No *M* are *S*
   No *S* are *P*

Answer: This is an invalid inference.
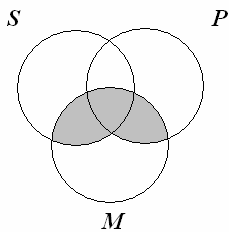
7. All *P* are *M*
    Some *S* are *M*
    All *S* are *P*

Answer: This is an invalid inference.
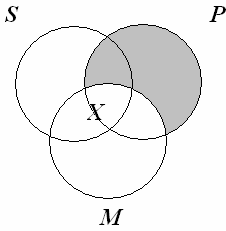
8. Some *P* are *M*
    Some *M* are not *S*
    Some *S* are not *P*

Answer: This is an invalid inference.
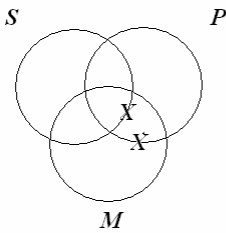
9. All *M* are *P*
    No *S* are *M*
    Some *S* are not *P*

Answer: This is an invalid inference.
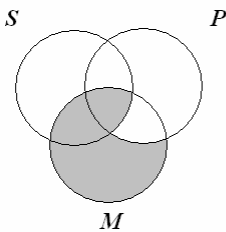
10. No *M* are *P*
    Some *S* are *M*
    Some *S* are *P*
Answer: This is an invalid inference.
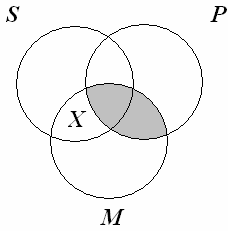
11. All *M* are *P*
    No *S* are *M*
    No *S* are *P*
Answer: This is an invalid inference.
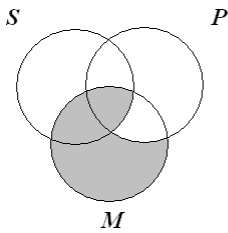
12. No *P* are *M*
    Some *S* are *M*
    Some *S* are not *P*
Answer: This is a valid inference.
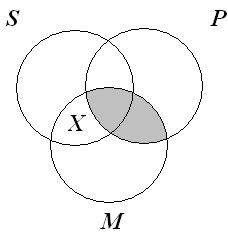
13. All *M* are *P*
    <u>All *S* are *M*</u>
    All *S* are *P*
Answer: This is a valid inference.
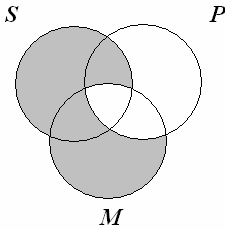
14. All *M* are *P*
    <u>Some *S* are not *M*</u>
    Some *S* are not *P*
Answer: This is an invalid inference.
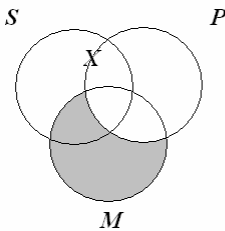
Translate the following inferences into standard-form categorical syllogisms. Then use Venn diagrams to prove the categorical syllogisms valid or invalid.

15. All fast food items are overpriced objects. No overpriced objects are nutritious products. Therefore, no nutritious products are fast food items.
Answer: Let *S* = "nutritious products," *P* = "fast food items," and *M* = "overpriced objects"
            All P are M
            <u>No M are S</u>
            No S are P
    This is a valid inference.
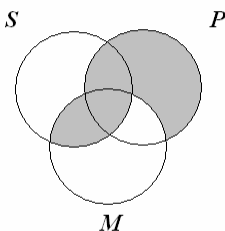
16. Some vegetables are not tasty foods. So, some tasty foods are not green, because some vegetables are not green.

Answer: Let *S* = "tasty foods," *P* = "green," and *M* = "vegetables"

Some M are not P
<u>Some M are not S</u>
Some S are not P

This is an invalid inference.
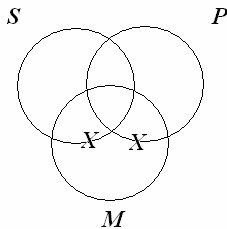
17. All mechanical objects are noisy. All airplanes are noisy. Thus, all airplanes are mechanical objects.
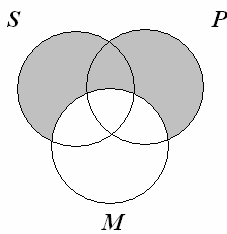
Answer: Let *S* = "airplanes," *P* = "mechanical objects," and *M* = "noisy"

All P are M
<u>All S are M</u>
All S are P

This is an invalid inference.

18. Some pens are not useful tools. This is because some pens are leaky writing implements, and no leaky writing implements are useful tools.

Answer: Let *S* = "pens," *P* = "useful tools," and *M* = "leaky writing implements"

No M are P
<u>Some S are M</u>
Some S are not P

This is a valid inference.
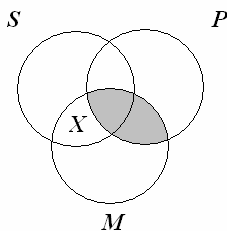
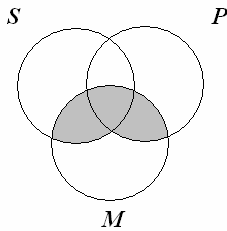19. No septic tanks are gaseous. No sewers are gaseous. Therefore, no septic tanks are sewers.

Answer: Let *S* = "septic tanks," *P* = "sewers," and *M* = "gaseous"

        No P are M
        <u>No S are M</u>
        No S are P

    This is an invalid inference.

20. All voice messages are a waste of time. Some games people play are a waste of time. So, some voice messages are games people play.
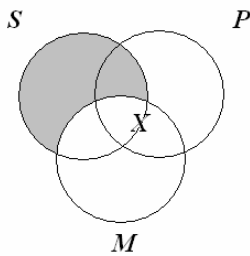
Answer: Let *S* = "voice messages," *P* = "games people play," and *M* = "waste of time"

        Some P are M
        <u>All S are M</u>
        Some S are P

    This is an invalid inference.

21. Some universities are not expensive places to attend. Some universities are conveniently located. Thus, some expensive places to attend are not conveniently located.

Answer: Let S = "expensive places to attend," P = "conveniently located," and M = "universities"

   Some M are P
   <u>Some M are not S</u>
   Some S are not P

  This is an invalid inference.
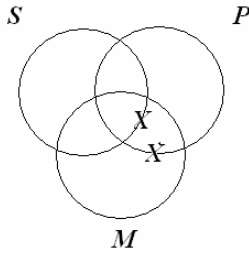
22. No sports fanatics are rational creatures. Therefore, no sports fanatics are benevolent people, since all rational creatures are benevolent people.

Answer: Let S = "sports fanatics," P = "benevolent people," and M = "rational creatures"

   All M are P
   <u>No S are M</u>
   No S are P

  This is an invalid inference.
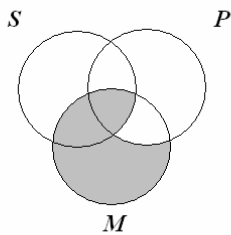
23. Some buildings are poorly constructed. Some buildings are architectural nightmares. So, some architectural nightmares are poorly constructed.

Answer: Let S = "architectural nightmares," P = "poorly constructed," and M = "buildings"

    Some M are P
    <u>Some M are S</u>
    Some S are P

  This is an invalid inference.
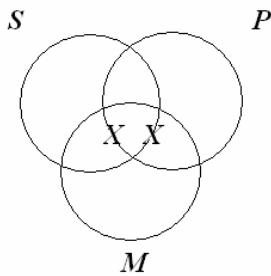
24. All sea creatures are intelligent animals. Some sea creatures are predators. So, some intelligent animals are predators.
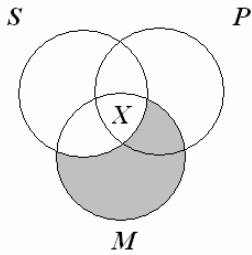
Answer: Let S = "intelligent animals," P = "predators," and M = "sea creatures"

    Some M are P
    <u>All M are S</u>
    Some S are P

  This is a valid inference.

Exercise Set -- A2.10

Answers:
1. *Major Term*: vegetarians
2. *Minor Term*: bears
3. *Middle Term*: animals
4. *Mood*: **EAE**
5. *Figure*: **1**

6. *Major Term*: parents
7. *Minor Term*: politicians
8. *Middle Term*: college students
9. *Mood*: **IOO**
10. *Figure*: **2**

11. *Major Term*: quiet vehicles
12. *Minor Term*: fast machines
13. *Middle Term*: jet airplanes
14. *Mood*: **EAE**
15. *Figure*: **3**

16. *Major Term*: cholesterol-free food
17. *Minor Term*: beef products
18. *Middle Term*: hot dogs
19. *Mood*: **EIO**
20. *Figure*: **1**

21. *Major Term*: independent creatures
22. *Minor Term*: loveable pets
23. *Middle Term*: cats
24. *Mood*: **OOO**
25. *Figure*: **3**

Exercise Set -- A2.11

1. **AII-3**
2. **EOO-1**
3. **AAA-2**
4. **III-2**
5. **OOO-3**
6. **EEE-4**
7. **AIA-2**
8. **IOO-4**
9. **AEO-1**
10. **EII-1**

11. *AAA-1*
Answer: This is a valid inference.
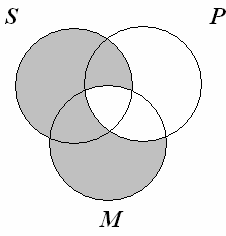
12. *AII-1*
Answer: This is a valid inference.
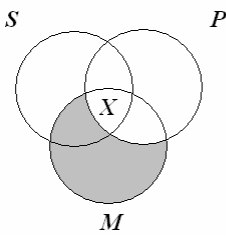
13. *EAE-1*
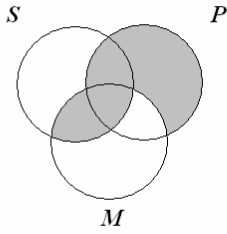*Answer:*   This is a valid inference.
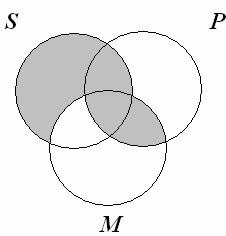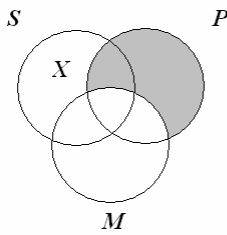

14. *EIO-1*
Answer: This is a valid inference.
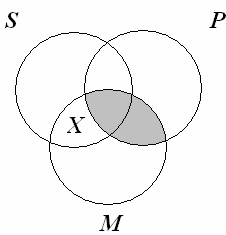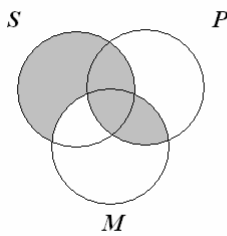
15. ***AEE-2***
Answer: This is a valid inference.
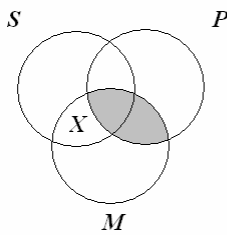

16. ***AOO-2***
Answer: This is a valid inference.
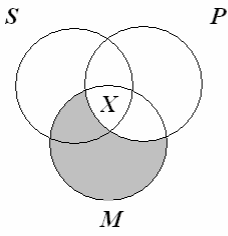

17. ***EAE-2***
Answer: This is a valid inference.

18. ***EIO-2***
Answer: This is a valid inference.
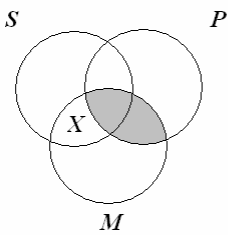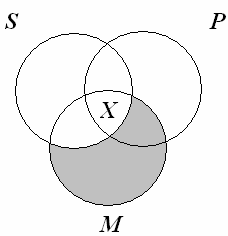
19. ***AII-3***
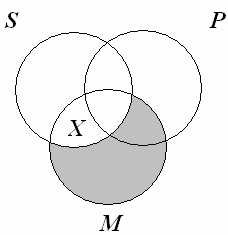*Answer:* This is a valid inference.

20. ***EIO-3***
Answer: This is a valid inference.

21. ***IAI-3***
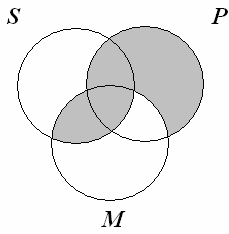*Answer:* This is a valid inference.

22. ***OAO-3***
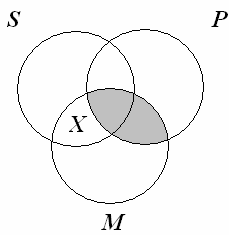*Answer:* This is a valid inference.

23. *AEE-4*
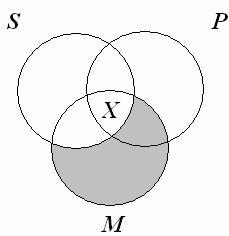*Answer:*   This is a valid inference.

24. *EIO-4*
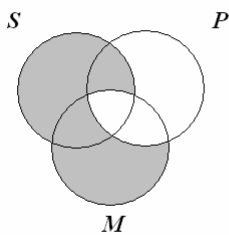*Answer:*   This is a valid inference.

25. *IAI-4*
Answer: This is a valid inference.
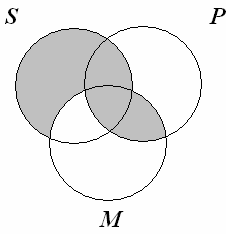

26. *AAI-1*
Answer: This is an invalid inference.
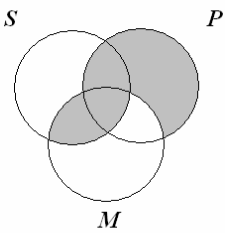
27. ***EAO-1***
Answer: This is an invalid inference.

28. ***AEO-2***
Answer: This is an invalid inference.

29. ***EAO-2***
Answer: This is an invalid inference.

30. ***AAI-3***
Answer: This is an invalid inference.

31. ***EAO-3***
Answer: This is an invalid inference.
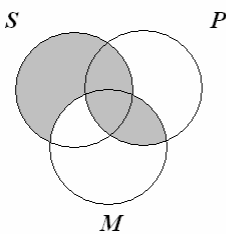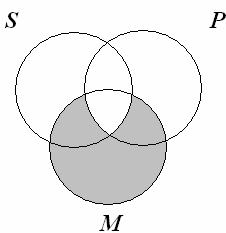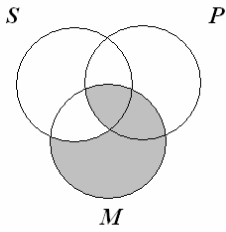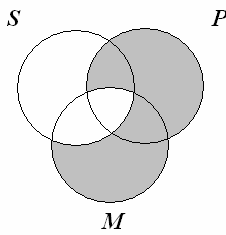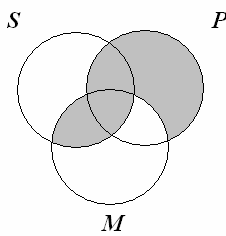

32. ***AAI-4***
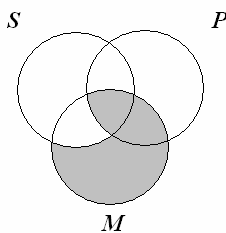*Answer:* This is an invalid inference.

33. ***AEO-4***
Answer: This is an invalid inference.

34. ***EAO-4***
Answer: This is an invalid inference.

35. All cultures that venerate senior citizens are built on a strong tradition of philosophical inquiry. Some recently developed cultures are not built on a strong tradition of philosophical inquiry. Therefore, some recently developed cultures are not cultures that venerate senior citizens.

Answer:　　Let S = "recently developed cultures," P = "cultures that venerate senior citizens," and M = "built on a strong tradition of philosophical inquiry"

All P are M
Some S are not M
Some S are not P

AOO-2
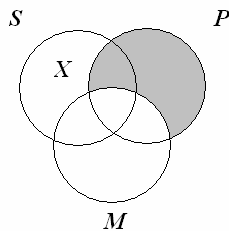
This is a valid inference.

36. Some planets with oxygen are capable of sustaining life. Some planets outside our solar system are planets with oxygen. So, some planets outside our solar system are capable of sustaining life.

Answer:　　Let S = "planets outside our solar system," P = "capable of sustaining life," and M = "planets with oxygen"

Some M are P
Some S are M
Some S are P

III - 1

This is an invalid inference.

37. All great works of literature are illuminations of the human predicament. No pulp fiction novels are great works of literature, because no pulp fiction novels are illuminations of the human predicament.
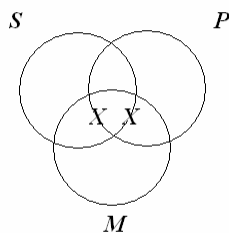
Answer: Let S = "pulp fiction novels," P = "great works of literature," and M = "illuminations of the human predicament"

All P are M
<u>No S are M</u>
No S are P

AEE – 2
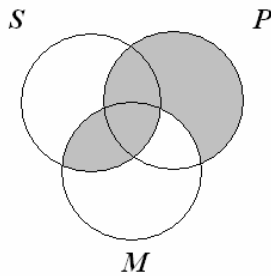
This is a valid inference.

38. All natural disasters are scientifically explainable phenomena. Some human maladies are scientifically explainable phenomena. Thus, some human maladies are natural disasters.

Answer: Let S = "human maladies," P = "natural disasters," and M = "scientifically explainable phenomena"

All P are M
<u>Some S are M</u>
Some S are P

AII - 2
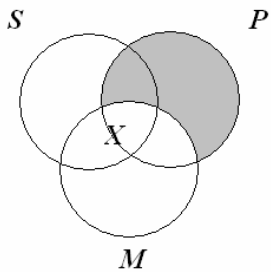
This is an invalid inference.

39. Some furry creatures are lovable. Some eccentric people are lovable. So, some eccentric people are furry creatures.

Answer: Let S = "eccentric people," P = "furry creatures," and M = "lovable"

Some P are M
Some S are M
Some S are P

III - 2

This is an invalid inference.

Test Bank *Questions* and *Answers*

Analyze each statement by doing the following: (1) identify the *subject* and *predicate terms;* (2) identify the standard form as either *A, E, I,* or *O*
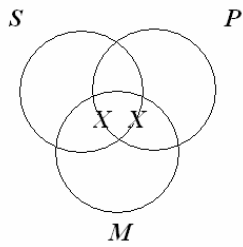
1. All senior citizens are eligible for discount coffee.
Answer:　　(1) Subject Term – "senior citizens," Predicate Term – "eligible for discount coffee."
　　　　　　(2) *A*
2. Some high schools are excellent places to learn.
Answer:　　(1) Subject Term – "high schools," Predicate Term – "excellent places to learn."
　　　　　　(2) *I*
3. Some families are not addicted to sitcoms.
Answer:　　(1) Subject Term – "families," Predicate Term – "addicted to sitcoms."
　　　　　　(2) *O*
4. No national parks are free to enter.
Answer:　　(1) Subject Term – "national parks," Predicate Term – "free to enter."
　　　　　　(2) *E*
5. All melons are vegetables in disguise.
Answer:　　(1) Subject Term – "melons," Predicate Term – "vegetables in disguise."
　　　　　　(2) *A*
6. Some movies are not suitable for children under the age of 13.
Answer:　　(1) Subject Term – "movies," Predicate Term – "suitable for children under the age of 13."
　　　　　　(2) *O*
7. All cats are pitiless bird snatchers.
Answer:　　(1) Subject Term – "cats," Predicate Term – "pitiless bird snatchers."
　　　　　　(2) *A*
8. Some bureaucracies are beneficial to society.
Answer:　　(1) Subject Term – "bureaucracies," Predicate Term – "beneficial to society."
　　　　　　(2) *I*
9. No games of chance are completely random.
Answer:　　(1) Subject Term – "games of chance," Predicate Term – "completely random."
　　　　　　(2) *E*
10. Some diet medicines are not legally obtainable.
Answer:　　(1) Subject Term – "diet medicines," Predicate Term – "legally obtainable."
　　　　　　(2) *O*

The categorical statements below are to be analyzed in three ways: (1) the correct *Quantity* (*universal* or *particular*); (2) the correct *Quality* (*affirmative* or *negative*); (3) the correct *Distribution* (subject term distributed, predicate term distributed, both distributed, or neither distributed).

11. All cheap ink pens are severely defective writing implements.
Answer:　　Universal Affirmative; Subject Term distributed; Predicate Term undistributed
12. Some music videos are not degrading to mortals.
Answer:　　Particular Negative; Subject Term undistributed; Predicate Term distributed.
13. No electronic equipment is submersible in water.
Answer:　　Universal Negative; Subject Term distributed; Predicate Term distributed.
14. Some MP3's are inexpensive.
Answer:　　Particular Affirmative; Subject Term undistributed; Predicate Term undistributed.
15. No frozen vegetables are nutritious.
Answer:　　Universal Negative; Subject Term distributed; Predicate Term distributed.
16. No tropical rain forests are safe from exploiters.
Answer:　　Universal Negative; Subject Term distributed; Predicate Term distributed.

17. Some colleges are members of the NCAA.
Answer: Particular Affirmative; Subject Term undistributed; Predicate Term undistributed
18. Some body-piercing shops are not sanitary places.
Answer: Particular Negative; Subject Term undistributed; Predicate Term distributed.
19. All fads are short-lived.
Answer: Universal Affirmative; Subject Term distributed; Predicate Term undistributed
20. No coffee drinkers are affable intellectuals.
Answer: Universal Negative; Subject Term distributed; Predicate Term distributed.

Use your understanding of the Aristotelian Square of Opposition to determine the correct answer.

21. The *contradictory* of "No herbal tea drinks are caffeine-free," is:
Answer: Some herbal tea drinks are caffeine-free.
22. Are the following two statements *contraries*?
　　　　All bingo games are fun and exciting.
　　　　No bingo games are fun and exciting.
　　a. Yes　　b. No
Answer: a. Yes
23. Are the following two statements *subcontraries*?
　　　　Some designer jeans are made in the USA.
　　　　Some designer jeans are not made in the USA.
　　a. Yes　　b. No
Answer: a. Yes
24. If it is true that "Some flowers are suitable gifts," then the statement "No flowers are suitable gifts," must be:
　　a. True　　b. False　　c. Undetermined
Answer: b. False
25. If it is false that "Some restaurants are carefully maintained," then the statement "No restaurants are carefully maintained," must be:
　　a. True　　b. False　　c. Undetermined
Answer: a. True
26. Based on the *Aristotelian Square of Opposition*, two *contradictory* categorical statements can both be true at the same time.
　　a. Yes　　b. No
Answer: b. No
27. If it is false that "Some taxi drivers are courteous," then the statement "All taxi drivers are courteous," must be:
　　a. True　　b. False　　c. Undetermined
Answer: b. False
28. If it is true that "Some hockey players are denture-free," then the statement "All hockey players are denture-free," must be:
　　a. True　　b. False　　c. Undetermined
Answer: c. Undetermined
29. If it is true that "No plaid underwear garments are attractive," then the statement "Some plaid underwear garments are not attractive," must be:
　　a. True　　b. False　　c. Undetermined
Answer: a. True
30. If it is false that "No electronic keyboards are easily transportable," then the statement "Some electronic keyboards are not easily transportable," must be:
　　a. True　　b. False　　c. Undetermined
Answer: c. Undetermined

For each of the following, provide the *converse*, *obverse*, and *contrapositive* of the given statement. If any of the subsequent immediate inferences are not valid, explain why.

31. Some fashion experts are frauds.
Answer: *Converse*: Some frauds are fashion experts.
                     Obverse: Some fashion experts are not nonfrauds.
                     Contrapositive: Not valid for *I*-statements.
32. Some dictionaries are not lightweight objects.
Answer: *Converse*: Not valid for *O*-statements.
                     Obverse: Some dictionaries are nonlightweight objects.
                     Contrapositive: Some nonlightweight objects are not nondictionaries.
33. No wedding rings are easily removable items.
Answer: *Converse*: No easily removable items are wedding rinds.
                     Obverse: All wedding rings are noneasily removable items.
                     Contrapositive: Some noneasily removable items are not nonwedding rings. (Valid by limitation)
34. All CD players are cutting-edge technology.
Answer: *Converse*: Some cutting-edge technology are CD players. (Valid by limitation)
                     Obverse: No CD players are noncutting-edge technology.
                     Contrapositive: All noncutting-edge technology are non-CD players.
35. No elected officials are prison trustees.
Answer: *Converse*: No prison trustees are elected officials.
                     Obverse: All elected officials are nonprison trustees.
                     Contrapositive: Some nonprison trustees are not nonelected officials. (Valid by limitation)

Translate the following sentences into standard-form categorical statements by stipulating what the *Subject* and *Predicate Terms* will stand for in each case. Then draw Venn diagrams to represent the logic of each statement.
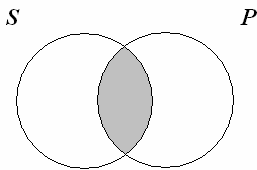
36. Some big game hunters are ecologically challenged.
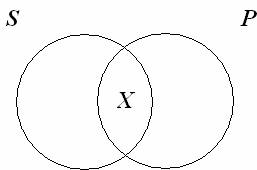*Answer:*   S = "big game hunters," P = "ecologically challenged"
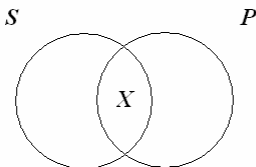
37. No lava lamps are entertaining.
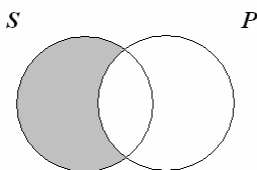*Answer:*   S = "lava lamps," P = "entertaining"

38. Some sports fans are mature people.
Answer: S = "sports fans," P = "mature people"
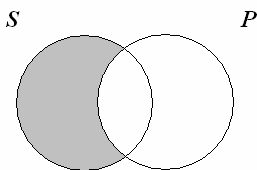
39. All cruise ships are buffet paradises.
Answer: S = "cruise ships," P = "buffet paradises"

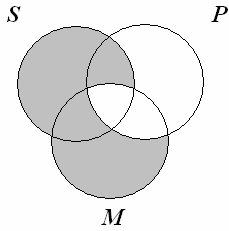40. All astrological forecasts are parapsychology nonsense.
Answer: S = "astrological forecasts," P = "parapsychology nonsense"

The following categorical syllogisms are to be analyzed by using Venn diagrams to prove whether they are valid or invalid.

41. All M are P
    All S are M
    All S are P
Answer: Valid

42. No M are P
    No S are M
    No S are P
Answer: Invalid
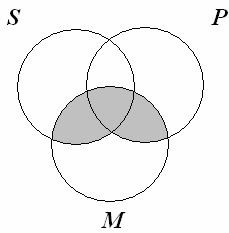
43. Some M are P
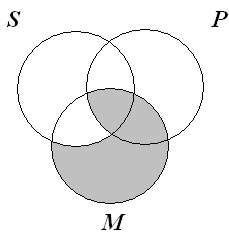   Some S are M
    Some S are P
Answer: Invalid
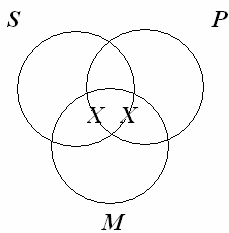
44. Some M are not P
    Some S are not M
    Some S are not P
Answer: Invalid
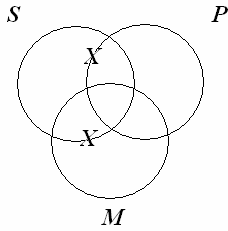
45. Some P are not M
    Some S are not M
    Some S are not P
Answer: Invalid
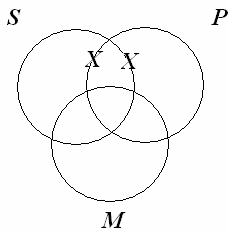
46. No P are M
    No S are M
    No S are P
Answer: Invalid
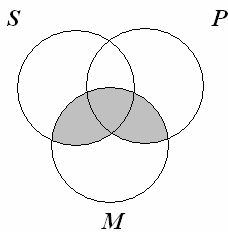
47. All P are M
     All S are M
     All S are P
Answer: Invalid
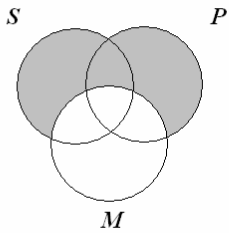
48. Some P are M
     Some S are M
     Some S are P
Answer: Invalid
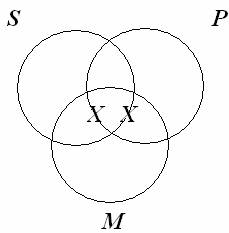
49. No M are P
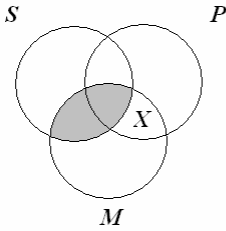   All M are S
     Some S are not P
Answer: Invalid

50. Some M are P
     <u>No M are S</u>
     Some S are not P
Answer: Invalid

Translate the following inferences into *standard-form categorical syllogisms.* Then use Venn diagrams to prove the categorical syllogisms valid or invalid.

51. Some parrots are not talkative animals. Some parrots are not comedians. So, some talkative animals are not comedians.
Answer: Invalid.   Let S = "talkative animals," P = "comedians," and M = "parrots."

     Some M are not P
     <u>Some M are not S</u>
     Some S are not P
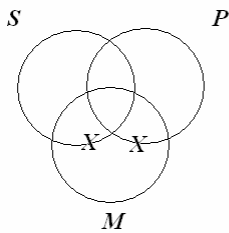
52. Some maps are not accurate. This is because some maps are obsolete reference items, and no obsolete reference items are accurate.
Answer: Valid.   Let S = "Maps," P = "accurate," and M = "obsolete reference items."
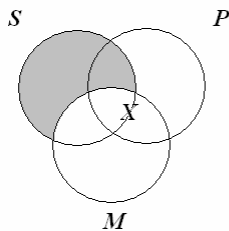
    No M are P
    <u>Some S are M</u>
    Some S are not P
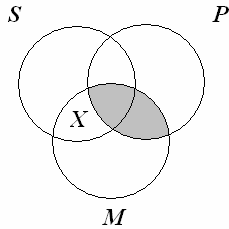
53. All answering machines are annoying. Some salespeople are annoying. So, some answering machines are salespeople.
Answer: Invalid.   Let S = "answering machines," P = "salespeople," and M = "annoying."

    Some P are M
    <u>All S are M</u>
    Some S are P

54. All diet soft drinks are artificially sweet. No politicians are diet soft drinks. Therefore, no politicians are artificially sweet.
Answer: Invalid.   Let S = "politicians," P = "artificially sweet," and M = "diet soft drinks."
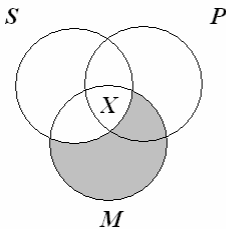
All M are P
No S are M
No S are P

.
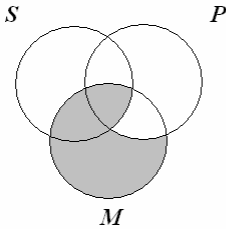
55. All classic literature is brain food. Some classic literature is profound. So, some brain food is profound.
Answer: Valid.   Let S = "brain food," P = "profound," and M = "classic literature."

Some M are P
All M are S
Some S are P

Reveal the *mood* and *figure* of each categorical syllogism.

56. All M are P
     All M are S
     All S are P
Answer: AAA-3
57. No P are M
     No M are S
     No S are P
Answer: EEE-4
58. All P are M
     Some S are M
     Some S are P
Answer: AII-2

59. Some M are P
    <u>Some M are not S</u>
    Some S are not P
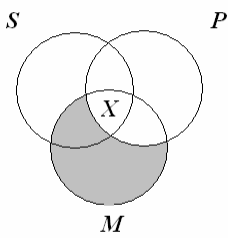*Answer:* **IOO-3**
60. Some M are not P
    <u>Some S are M</u>
    Some S are P
Answer: **OII-1**

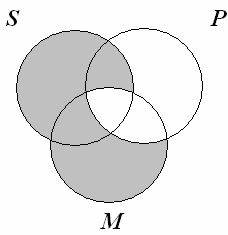Use Venn diagrams to prove the following are either valid or invalid.
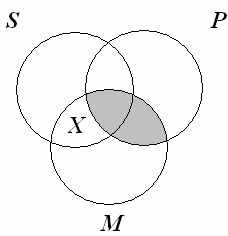
61. **AII-1**
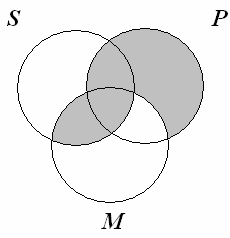*Answer:*   Valid

62. **AAI-1**
Answer: Invalid
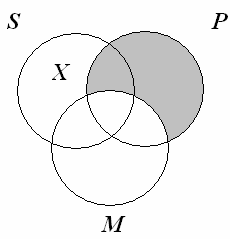

63. **EIO-1**
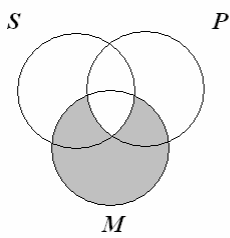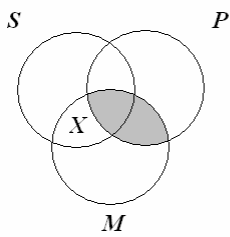*Answer:*   Valid

64. *AEO-2*
Answer: Invalid

65. *AOO-2*
Answer: Valid

66. *AAI-3*
Answer: Invalid

67. *EIO-2*
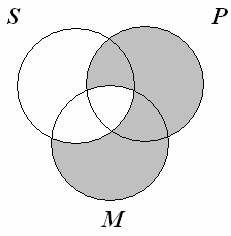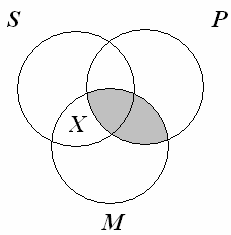*Answer:*   Valid

68. ***AAI-4***
Answer: Invalid

69. ***EIO-3***
Answer: Valid

70. ***EAO-4***
Answer: Invalid