

3E Lewis Carroll Puzzles

Once master the machinery of Symbolic Logic, and you have a mental occupation always at hand, of absorbing interest, and one that will be of real use to you in any subject you may take up. It will give you clearness of thought - the ability to see your way through a puzzle - the habit of arranging your ideas in an orderly and get-at-able form - and, more valuable than all, the power to detect fallacies, and to tear to pieces the flimsy illogical arguments, which you will so continually encounter in books, in newspapers, in speeches, and even in sermons, and which so easily delude those who have never taken the trouble to master this fascinating Art.

Lewis Carroll



Lewis Carroll, cleaning a lens

Lewis Carroll may have exaggerated a little, as math professors often do about the utility of their subject. Carroll is best known for his nonsensical books, including the infamous “Alice in Wonderland”, written for children of ages five to ninety; but his main line of work was as a professor of mathematics at Oxford University in England. He studied logic as a vocation, and he played with logic in his writings. His stories of little girls and strange creatures are filled with bad puns and other plays with words, absurd implications, contradictions, and numerous and various offenses to common sense. It is as though he were writing his silly stories as much to amuse himself as to entertain his audiences.



According to the Mock Turtle, the four branches of arithmetic are
 (1) Ambition
 (2) Distraction
 (3) Uglication
 (4) Derision.

As a teacher of logic and a lover of nonsense, Carroll designed entertaining puzzles to train people in systematic reasoning. In these puzzles he strings together a list of implications, purposefully inane so that the reader is not influenced by any preconceived opinions. The job of the reader is to use all the listed implications to arrive at an inescapable conclusion. You will get the general idea after a few examples.

We begin with one of Lewis Carroll's simpler puzzles, and work our way up to harder ones.

Puzzle # 1

- (a) All babies are illogical.
- (b) Nobody is despised who can manage a crocodile.
- (c) Illogical persons are despised.

As the subjects of this puzzle are people, we take the universe as the set of all people. We will rewrite each statement in the puzzle as an implication. First we define simpler statements,

B : it is a baby

M : it can manage a crocodile

L : it is logical

D : it is despised ,

where “it” in this context refers to a general person. Then the three statements can be rephrased as

- (a) $B \rightarrow \sim L$: If it is a baby then it is not logical.

- (b) $M \rightarrow \sim D$: If it can manage a crocodile then it is not despised.
 (c) $\sim L \rightarrow D$: If it is not logical then it is despised.

Our aim is to use transitive reasoning several times, stringing together a chain of implications using all the given statements. We have an arrow pointing from B to $\sim L$, and likewise an arrow pointing from $\sim L$ to D; thus we are able to start with B and arrive at the conclusion D. However, the second statement is still not utilized. But since any implication is equivalent to its contrapositive, we may replace the second statement with its contrapositive $D \rightarrow \sim M$. Then we get the transitive reasoning chain

$$B \rightarrow \sim L \rightarrow D \rightarrow \sim M.$$

We reason that if B is true, then $\sim L$ is true, hence D is true, and therefore $\sim M$ is true. Our ultimate conclusion is the statement

$$B \rightarrow \sim M : \text{If it is a baby then it cannot manage a crocodile.}$$

In ordinary language we would more likely rephrase this answer to the puzzle as

“No baby can manage a crocodile.”

Alternatively, we could write the answer as the contrapositive statement

$$M \rightarrow \sim B : \text{If it can manage a crocodile then it is not a baby.}$$

The translation into words then would be something like

“Anyone who can manage a crocodile is not a baby.”



Next we consider a Lewis Carroll puzzle with four statements.

Puzzle # 2

- (a) None of the unnoticed things, met with at sea, are mermaids.
 (b) Things entered in the log, as met with at sea, are sure to be worth remembering.
 (c) I have never met with anything worth remembering, when on a voyage.
 (d) Things met with at sea, that are noticed, are sure to be recorded in the log.

After a careful reading of the statements, we deduce that the subjects under discussion belong to the somewhat vague

category “things met with at sea”, and so we take this set as the universal set. Our simpler statements are

- N : it is noticed
 M : it is a mermaid
 L : it is entered in the log
 R : it is worth remembering
 I : I have met with it at sea .



We write each of the statements (a) - (d) symbolically, along with each statement's contrapositive :

- (a) $\sim N \rightarrow \sim M$, $M \rightarrow N$
 (b) $L \rightarrow R$, $\sim R \rightarrow \sim L$
 (c) $I \rightarrow \sim R$, $R \rightarrow \sim I$
 (d) $N \rightarrow L$, $\sim L \rightarrow \sim N$.

Next we gaze at the symbolic statements until we discover that we can string them all together as
 $I \rightarrow \sim R \rightarrow \sim L \rightarrow \sim N \rightarrow \sim M$.

Therefore, the solution to the puzzle is the implication

$I \rightarrow \sim M$: If I have met with it at sea then it is not a mermaid .

Alternatively, we could choose the contrapositive

$M \rightarrow \sim I$: If it is a mermaid then I have not met with it at sea .

A preferable translation into ordinary language is

“I have never met with a mermaid at sea.”

Lastly, we solve a Lewis Carroll puzzle with five statements.

Puzzle # 3

- (a) No interesting poems are unpopular among people of real taste.
 (b) No modern poetry is free from affectation.
 (c) All *your* poems are on the subject of soap-bubbles.
 (d) No affected poetry is popular among people of real taste.
 (e) No ancient poem is on the subject of soap-bubbles.

The universe in this puzzle is the collection of all poems, while the five assertions are implications involving the simpler statements

- I : it is interesting , P : it is popular among people of real taste
 M : it is modern , A : it is affected
 Y : it is your poem , S : it is on the subject of soap bubbles .

Again, we write each statement symbolically, along with its contrapositive:

- (a) $I \rightarrow P$, $\sim P \rightarrow \sim I$
 (b) $M \rightarrow A$, $\sim A \rightarrow \sim M$
 (c) $Y \rightarrow S$, $\sim S \rightarrow \sim Y$
 (d) $A \rightarrow \sim P$, $P \rightarrow \sim A$



$$(e) \quad \sim M \rightarrow \sim S \quad , \quad S \rightarrow M .$$

You may have noticed in our previous two puzzles that the string of implications connecting all the statements begins with a letter occurring in only one of the assertions. In this puzzle the letters Y and I meet this criterion. If we begin with the letter I we produce the chain

$$I \rightarrow P \rightarrow \sim A \rightarrow \sim M \rightarrow \sim S \rightarrow \sim Y ,$$

and if we begin with the letter Y we create the contrapositive chain,

$$Y \rightarrow S \rightarrow M \rightarrow A \rightarrow \sim P \rightarrow \sim I .$$

Thus the solution to the puzzle is $I \rightarrow \sim Y$, or the equivalent contrapositive $Y \rightarrow \sim I$. The simplest translation back into words is perhaps the cruel statement

“Your poetry is not interesting.”

EXERCISES 3E

Lewis Carroll created these puzzles. In each puzzle you are to write the assertions symbolically as implications, along with their contrapositives, and then string together with arrows all the assertions to arrive at a final conclusion. Your answer will be an ultimate implication, which you must then cleverly translate back into ordinary language.

1. My saucepans are the only things I have that are made of tin.
I find all *your* presents very useful.
None of my saucepans are of the slightest use.



2. No potatoes of mine, that are new, have been boiled.
All my potatoes in this dish are fit to eat.
No unboiled potatoes of mine are fit to eat.

3. No ducks waltz.
No officers ever decline to waltz.
All my poultry are ducks.



4. Every one who is sane can do Logic.
No lunatics are fit to serve on a jury.
None of *your* sons can do logic.

5. No experienced person is incompetent.
Jenkins is always blundering.
No competent person is always blundering.



6. All puddings are nice.
This dish is a pudding.
No nice things are wholesome.

7. No one takes in the Times, unless he is well educated.
No hedgehogs can read.
Those who cannot read are not well educated.



8. All the old articles in this cupboard are cracked.
No jug in this cupboard is new.
Nothing in this cupboard, that is cracked, will hold water.

9. All unripe fruit is unwholesome.
All these apples are wholesome.
No fruit, grown in the shade, is ripe.



10. All hummingbirds are richly colored..
No large birds live on honey.
Birds that do not live on honey are dull in color.
11. Colored flowers are always scented.
I dislike flowers that are not grown in the open air.
No flowers grown in the open air are colorless.

12. All my sons are slim.
No child of mine is healthy who takes no exercise.
All gluttons, who are children of mine, are fat.
No daughter of mine takes any exercise.





13. Things sold in the street are of no great value.
 Nothing but rubbish can be had for a song.
 Eggs of the Great Auk are very valuable.
 It is only what is sold in the street that is really *rubbish*.

14. No birds, except ostriches, are 9 feet high.
 There are no birds in this aviary that belong to anyone but *me*.
 No ostrich lives on mince pies.
 I have no birds less than 9 feet high.



15. No boys under 12 are admitted to this school as boarders.
 All the industrious boys have red hair.
 None of the dayboys learn Greek.
 None but those under 12 are idle.

16. The only articles of food, that my doctor allows me, are such as are not very rich.
 Nothing that agrees with me is unsuitable for supper.
 Wedding cake is always very rich.
 My doctor allows me all articles of food that are suitable for supper.



17. The only books in this library, that I do *not* recommend for reading, are unhealthy in tone.
 The bound books are all well written.
 All the romances are healthy in tone.
 I do not recommend you to read any of the unbound books.

18. All writers, who understand human nature, are clever.
 No one is a true poet unless he can stir the hearts of men.
 Shakespeare wrote "Hamlet".
 No writer, who does not understand human nature, can stir the hearts of men.
 None but a true poet could have written "Hamlet".



19. Promise breakers are untrustworthy.
 Wine drinkers are very communicative.



A man who keeps his promises is honest.
 No teetotalers are pawnbrokers.
 One can always trust a very communicative person.

20. I despise anything that cannot be used as a bridge.
 Everything, that is worth writing an ode to, would be a welcome gift to me.
 A rainbow will not bear the weight of a wheelbarrow.
 Whatever can be used as a bridge will bear the weight of a wheelbarrow.
 I would not take, as a gift, a thing that I despise.



21. No kitten, that loves fish, is unteachable.
 No kitten without a tail will play with a gorilla.
 Kittens with whiskers always love fish.
 No teachable kitten has green eyes.
 No kittens have tails unless they have whiskers.



22. Animals, that do not kick, are always unexcitable.
 Donkeys have no horns.
 A buffalo can always toss one over a gate.
 No animals that kick are easy to swallow.
 No hornless animal can toss one over a gate.
 All animals are excitable, except buffaloes.



23. No shark ever doubts that he is well fitted out.
 A fish, that cannot dance a minuet, is contemptible.
 No fish is quite certain that it is well fitted out, unless it has three rows of teeth.
 All fishes, except sharks, are kind to children.
 No heavy fish can dance a minuet.
 A fish with three rows of teeth is not to be despised.



24. No one, who is going to a party, ever fails to brush his hair.
 No one looks fascinating, if he is untidy.



Opium eaters have no self-command.
 Everyone, who has brushed his hair, looks fascinating.
 No one wears white kid gloves, unless he is going to a party.
 A man is always untidy, if he has no self-command.

25. The only animals in this house are cats.
 Every animal is suitable for a pet, that loves to gaze at the moon.
 When I detest an animal, I avoid it.
 No animals are carnivorous, unless they prowl at night.
 No cat fails to kill mice.
 No animals ever take to me, except what are in this house.
 Kangaroos are not suitable for pets.
 None but carnivora kill mice.
 I detest animals that do not take to me.
 Animals, that prowl at night, always love to gaze at the moon.

