Lesson 1

K.L.E.TECHNOLOGICAL UNIVERSITY
DEPARTMENT OF HUMANITIES

PROFESSIONAL APTITUDE AND LOGICAL REASONING

Contact Person:Dr. Jayaraman Calicut Training Centre, Bangalore – 560 097 ,mail :ccgmail.in

Boolean Logic

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Vidyanagara
Bangalore-560 024
Phone +91-9663-31323 • E-mail:ccgmail.in

☞ Introduction
☞ Lesson 1 Boolean Logic
☞ Solve puzzles using logical truth tables
☞ Solve puzzles using Venn diagrams

"There are only 10 types of people in the world: Those who understand binary, and those who don't."
Anonymous

Boolean Logic is based on George Boole's algebra. Boolean algebra, as you are aware of, consists of two values, namely, true and false. **True** or **False**, if an statement is a statement, it can only assume one of two values. It is not unlimited the following three terms are boolean.
Parodox
Contradiction
Logical Fallacy

Parodox

A paradox is an apparently true statement or group of statements that leads to a contradiction or a situation in which it seems to defy logic or defy intuition. Typically the statement in question or set of statements may not really be contradiction or the puzzling result is not really a contradiction. Paradoxes are usually the result of a faulty or misleading use of language or reasoning. The recognition of ambiguity, equivocation, and assumed assumptions underlying known paradoxes has often led to significant advances in science, philosophy, and mathematics.

Common themes in paradoxes include direct and indirect self-reference, infinity, and the distinction between different levels of meaning. Paradoxes which are not based on a hidden error generally happen at the fringes of certain or language, and require extending the context (or language) to lose their paradox quality.

The Liar Paradox
In philosophy and logic, the liar paradox encompasses paradoxical statements such as:
"I am lying now."
or
"This statement is false."
To avoid having a sentence directly refer to its own truth value, one can also construct the paradox as follows:
Statement 1 – The following sentence is true.
Statement 2 – The preceding sentence is false.
The oldest version of the liar paradox is attributed to the Greek philosopher Eubulides of Miletus who lived in the fourth century B.C. Eubulides reportedly said:
"A man says that he is lying. Is what he says true or false?"
Epimenides was a sixth century BC philosopher-poet **himself a Cretan**, he reportedly wrote:
"The Cretans are always liar! (Bible, NT, Titus 1:12)

The problem of the **paradox is that it appears to show that our most cherished common beliefs about truth and falsehood are in error, or at least inconsistent**. Paradoxes are also problematic because they are completely in accord with grammar and semantics, but they fail cannot consistently be assigned a truth value.

Consider the simplest version of the paradox, the sentence **"This statement is false"** If we assume that this statement is true, then what it says is true, and we are forced to conclude that it is false. On the other hand, if we assume that it is false, it must be false. So assuming that it is true leads to the contradiction that it is true and false. OR, can we assume that it is false? No, that assumption also leads to contradiction: if the statement is false, then what it says about itself is not true. So says that it is false, so that must not be true. Hence, it is true. Under either assumption, we end up concluding that the statement is both true and false. Since it is not true that it is false, it is true, and since it is true it is false and so it is false. Hence there seems to be a contradiction at the heart of our beliefs about truth and falsity.

When you're dealing with the principle of contradiction there is indeed only this case left for discussion.

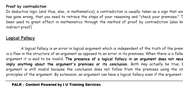
The Barber Paradox

The Barber paradox is a paradox that relates to mathematical logic and set theory. The paradox considers a town with a male barber who shaves daily every man who does not shave himself, and no one else. Such a town cannot exist:

If the barber does not shave himself, he must abide by the rule and shave himself.
If he does shave himself, according to the rule he will not shave himself
Then the rule results in an impossible situation.

Contradiction

Broadly speaking, a contradiction is when two or more statements, ideas, or actions are seen as incompatible. One must in some regard at least one of the ideas outright. So logic contradiction is defined much more specifically than this. A contradiction is a conjunction consisting of a statement and its negation "Logical" can be used instead of "logical" to contrast opposed and in dialectical methodology, the word "contradiction" has a completely different meaning than in formal logic.



Proof by contradiction

In deductive logic (and thus, also in mathematics), a contradiction is usually taken as a sign that something has gone wrong, that you need to retrace the steps of your reasoning and "check your premises." This has been a very great effort in mathematics through the method of proof by contradiction (also known as reductio ad absurdum).

Logical Fallacy

A logical fallacy is an error in logical argument which is independent of the truth of the premises. It is a flaw in the structure of an argument as opposed to an error in its premises. When there is a fallacy in an argument it is said to be invalid. **The presence of a logical fallacy in an argument does not necessarily imply that the conclusion is false, but it does imply that the argument is invalid.** A fallacy in an argument is an invalid reason that conclusion does not follow from the premises using the inference principles of the argument. By extension, an argument can have a logical fallacy even if the argument is not a

purely logical one, for instance an argument that incorrectly applies principles of probability or causality can be said to have a logical fallacy.
Some acts of telling human beings are legal in this state.
Some acts of telling human beings are illegal in this state.
Therefore some acts of telling human beings are both legal and illegal in this state.
This is fallacious. Indeed, there is no logical principle which states:

For some x, F(x) For some y, G(y). Then for some z, F(z) and G(z).

The easiest way to show the above inference is invalid is by using Venn diagrams.

Now let's try to solve a puzzle based on the Boolean Logic.

2 nun two actress an island : Bonny and Betty . Bonny always lies . Betty always tells the truth . Bonny and Betty are identical twins . They not the same . Bonny : We are both of the same type. Bonny : I am a lioness Betty : I am a tiger. Bonny : Betty is the nun who Lenny is what they were . What are Bonny and Betty ?

Now, if 2 nun told their Lenny was a bright girl.

Bright or a liar or a lioness. **Bonny is a lioness and Betty is a tiger.**

From this 2 was able to work out Lenny?

then 2 get a paradox, so that's not right.

If 2 was told that Lenny is a lioness Bonny could still be a liar or a lioness, so that isn't right either, because the puzzle states that 2 was able to determine what Bonny is by knowing what is Lenny.

If 2 was told that Lenny was a liar, then Bonny's second statement is true. This means his first statement is false, so he cannot be a liar, so he can only be a lioness.
While the statements above allow for more than one possibility for their types, being told that Lenny is a liar allows 2 to determine what Bonny is by knowing what is Lenny.

So the answer is that 2 was told that Lenny was a liar and 2 was that Bonny was a lioness.

The inhabitants of an island always answer any question with two sentences, one of which is always true and the other is always false. Tommy is walking on a path and comes to a fork. He asks the inhabitants Max, Peter and Zane the same question "Which path will take me to the town?"
Max: Peter always speaks in strangers; I am one to these parts.
Zane: I am normal to Max. He is not new to this place.
Peter: I am normal to Zane. Take the left path.
Which path Jimmy Walker take to reach the town?
L.Left R.Right 2. Cannot be determined

Solution: Let us now solve this problem.
Since one would make directions only if one is a stranger to a place, the first statement of Bruce implies that Bruce is a stranger. Since Bruce is a stranger, the second statement of Bruce is false. Therefore, the first statement has to be false. In which case, from the notes, Alex's second statement has to be true.

	FIRST STATEMENT	SECOND STATEMENT
MAX	FALSE	TRUE
JANE		
PETER		

As a result, Zane's second statement has to be false and her first statement true.

	FIRST STATEMENT	SECOND STATEMENT
MAX	FALSE	TRUE
JANE	TRUE	FALSE
PETER		

Therefore, Peter's first statement has to be false, and his second statement true. The answer to the question is -1. You should take the path on the left.

	FIRST STATEMENT	SECOND STATEMENT
MAX	FALSE	TRUE
JANE	TRUE	FALSE
PETER	FALSE	TRUE

The answer to the question is - 1. Jimmy Walker should take the path on the left.

Approach for Answering Such Questions

A. Identify if there is a statement which has to be certainly true or certainly false. Then, based on this statement conclude the remaining statements to be true or false.

OR

B. Form a Truth Table. Assume a sentence to be true or false alternatively and write the states in the truth table. Then, based on this statement conclude the remaining statements to be true or false. Check if the statement which is the correct one. If there is no unique solution, the answer cannot be determined.

Let us see an example of the second approach and another type of puzzle. **A famous author was kidnapped and the police round up the usual suspects: During the interrogation of the four men the following accusations and statements are made:**
Anderson said "Brimmers did it."
Brimmers said "Dodge did it."
Carter said "I did not do it."
Dodge said "Brimmers lied when he said I did it."

If only one of the four was are untruthful, which man committed the crime?

If Anderson lied, then the statements made by Brimmers and Dodge contradict each other, as Anderson cannot be the liar.

If Carter lied, then, again, the statements made by Brimmers and Dodge contradict each other, as Carter cannot be the liar. At this point you should be able to see that the key to the puzzle is in the contradictory statements made by Brimmers and Dodge.
If Dodge lied, then the statements made by Anderson and Brimmers cannot both be true (assuming only one man was guilty).
Therefore we are left with only one option.
If Brimmers had when he accused Dodge, then Anderson could truthfully say about Brimmers did it. Brimmers truthfully deny being involved, and Dodge could truthfully claim that Brimmers wrongfully accused him.

Since Anderson was telling the truth when he accused Brimmers, **Brimmers is the guilty man.**

Brain Drill

1. **Shahrukh Versus Salman**
Shahrukh speaks truth only in the morning and lies in the afternoon, whereas Salman speaks truth only in the afternoon and lies in the morning.
A says that it is Shahrukh.
Q: If morning or afternoon and who is A - Shahrukh or Salman?

2. **Spirited Effort**
You are an expert on paranormal activity and have been hired to locate a spirit haunting an old haunted house. Every spirit that the spirit has lashed out at four doors. The descriptions on each door read as follows:
Door A: It's behind B or C
Door B: It's behind A or D
Door C: It's a hare
Door D: It's behind A
Four psychic guesses hold you three of the descriptions are false, and one is true. Behind which door will you find the spirit?

3. **Hunting Hoax**
BOOGE, a world travel company, was commissioned by the magazine Country Today to undertake such gallo. A agent of BOOGE sent three writers who had just cast their votes.
When asked, how many of them voted in favour of Zaneta Party, the replies were -
Antony: Just one of us.
Solomon: Two of us.
Knight: Antony does not vote.
"Antony did you vote for the Zaneta Party?" persisted the representative.
Antony: I lied.
Solomon: Antony is lying, he had a fact.
Knight: Antony did not vote for the Zaneta Party.
If it is given that one of the three respondents is a knight (speaks truth always), one of the three is a liar (spoke lies always), and one of the three is a knave (spoke a truth and a lie alternately), and that one or more votes were cast in favour of the Zaneta Party.

5. Which of the following spoke the truth always?
1. A 2. B
3. Knight 4. Cannot be determined with certainty

4. Which of the following voted for the Zaneta Party?
1. Antony 2. Solomon
3. Knight 4. Cannot be determined with certainty

5. Which of the following spoke a truth and a lie alternately?
1. Antony 2. Solomon
3. Knight 4. Cannot be determined with certainty

Questions 6 – 9
There are three gentlemen who pursue three different hobbies. The three gentlemen, masters of logic, gave their respective hobbies in a cryptic way. Each of the three gentlemen, in a cryptic manner, described the other two. They further informed you that one of them is a knight (speaks the truth always), one of them is a liar (lied always), and one of them is a knave (spoke one truth and one lie).
A: Cricket is my hobby, B is a gamer.
B: Cricket is my hobby, A is a gamer.
C: A hobby is golf. My hobby is photo.
Answer the following questions

6. Whose hobby is photo?
1. A 2. B
3. C 4. Cannot be determined with certainty

7. Whose hobby is gaming?
1. A 2. B
3. C 4. Cannot be determined with certainty

8. Who spoke two always?
1. A 2. B
3. C 4. Cannot be determined with certainty

9. Who spoke one truth and one lie?
1. A 2. B
3. C 4. Cannot be determined with certainty

10. **Family Vacations**
A vacationing family arriving around the campfire has the following conversation:
1. Father: What day is it? I am sure it isn't Tuesday, Wednesday or Thursday.
2. Mother: Yesterday was Friday. Tomorrow is Monday. Sunday is Tuesday.
3. Father: You mean that I think about it. yesterday was Friday, tomorrow is Friday.

4. Zac the day after tomorrow is Thursday.
5. Bethel is the day before Wednesday.
6. Bethel is the day after Thursday today.
7. Zac: All we know for sure is that it wasn't Sunday yesterday.

If only one statement above is true, what day of the week is ?

Questions 11 – 14

B O O L E A N L O G I C

A young student, Bogel, complained to the teacher that three of his classmates conspired and stole his pen. The teacher called three accused, Ram, Robert and Rahim and sought their explanation. In order to confuse the teacher the three accused gave the following answers.

Ram: Robert distracted Bogel's attention. Rahim opened Bogel's bag.
Robert: Rahim distracted Bogel's attention. I removed the pen
from Bogel's bag.
Rahim: I opened Bogel's bag. Robert distracted Bogel's attention.

The teacher knew that one of thrisa had the habit of speaking lies always, one spoke the truth always, and one alternated truth with lie. Find out 27 each of thrisa accused underlined only one of the activities listed.

10. Who removed the pen from Bogel's bag?
1. Ram 2. Robert
3. Rahim 4. Cannot be determined with certainty

11. Who distracted Bogel's attention?
1. Ram 2. Robert
3. Rahim 4. Cannot be determined with certainty

12. Who opened the Bogel's bag?
1. Ram 2. Robert
3. Rahim 4. Cannot be determined with certainty

13. Who distracted Bogel's attention?
1. Ram 2. Robert
3. Rahim 4. Cannot be determined with certainty

14. Who opened Bogel's bag?
1. Ram 2. Robert
3. Rahim 4. Cannot be determined with certainty

Questions 15-18

On your recent visit to Kyn-Kyn island, you come across three inhabitants. As you were already aware, each of the inhabitants speaks two sentences at one time. The inhabitants are of two types: those who speak truth always, and those who speak lies always. You great the three inhabitants and ask them their names - let us for the time being call them X, Y and Z.

X's name is Anthony. Z's name is Christopher.
Y's name is Anthony. Z's name is Anthony.
Z: My name is Anthony. Y's name is Donald.

Of two of the three inhabitants always spoke lies, and the third always the truth, and of each of three inhabitants had only one of the three names listed.
Of the three name is listed 2

1. X 2. Y 3. Z 4. Cannot be determined with certainty

16. Whose name is Christopher?
1. X 2. Y 3. Z 4. Cannot be determined with certainty

17. Who speaks the truth always?
1. X 2. Y 3. Z 4. Cannot be determined with certainty

B O O L E A N L O G I C

18. So which of the following pairs do you find Anthony?
1. X, Y 2. X, Z
3. Both I & 2 4. Cannot be determined with certainty

Questions 19 - 23

Three young men, enthusiastic hackers, were caught when they tried to break-into a commercial banks computer system. During interrogation they tried to confuse the police by giving the following responses:
Vishnu: I did not transfer money into Vishnu's account.
Vishnu: We used Dhananjay's computer. Rahim transferred Raj's crore into his account.
Dhananjay: Rahim cracked the password. We used Vishnu's personal computer.
Upon checking the computer they found that the three hackers had cracked that one of the three was speaking the truth, one of the three was lying, and one of the three spoke a truth and a lie. Of each of the three hackers was involved in only one of the three activities listed.

19. Who cracked the password?
1. Vishnu 2. Dhananjay
3. Srinivas 4. Cannot be determined with certainty

20. Who whose account was the money transferred?
1. Rahim 2. Vishnuv
3. Srinivas 4. Cannot be determined with certainty

21. Who spoke, alternately, a truth and a lie?
1. Vishnu 2. Dhananjay
3. Srinivas 4. Cannot be determined with certainty

22. Whose personal computer was put to use?
1. Rahim 2. Vishnuv
3. Srinivas 4. Cannot be determined with certainty

23 – 26 Sa Pachchi

Vasanta met three missed-three classes in a week wanted to know which faculty handled those sessions. The three sessions in question were in English Usage, Elementary Grammar and Binary Logic. The three faculty members who handled exactly one of the three sessions were Vasanta, Vaishnavi and Vasavi. To the student's query the three faculty members gave the following responses

Vasanta: I took the session on English Usage. Vasavi took the session on Binary Logic.
Vaishnavi: I took the session on Binary Logic. Vasanta took the session on Elementary
Vasavi: I took the session on English Usage. Vasanta took the session on Binary Logic.

They asked the student to find out who took which session, given that one of them spoke the truth always, one of them spoke two always, and one of them spoke a truth and a lie alternately.

23. Of the puzzle in the student was designed by the faculty who took the session on Binary Logic, who designed the puzzle?
1. Vasanta 2. Vaishnavi
3. Vasavi 4. Cannot be determined with certainty

24. Who took the session on English Usage?

B O O L E A N L O G I C

25. Who took the session on Elementary Grammar?
1. Vasanta 2. Vaishnavi
3. Vasavi 4. Cannot be determined with certainty

26. Which of the following sessions was handled by the faculty who spoke two always?
1. English Usage 2. Gramerry
3. Binary Logic 4. Cannot be determined with certainty

27 – 28 Logic Science

Three students were declared, at the same time, the discovery a new gene. Each of the three claimed that he was the first to discover the gene. Each of them had spent all of promising but original research. Each of them claimed that he should be credited with the discovery, and started questioning the veracity of the claims of the other two scientists. At the international Science Congress the Governing Body decided to find out if any of the scientists had plagiarized. The three scientists are Karth, Zamara and Harold. Only one of them had actually discovered the gene.

Karth: Harold could not have discovered the gene. Zamara plagiarized my research results.
Zamara: I discovered the gene. Karth stole my data. Harold plagiarized Karth's research results.
Harold: I discovered the gene using my own research experiment. Zamara could not have discovered the gene.

Given that only one of the three scientists speak truth always, and that the other two always a lie and a truth alternately,

27. Who discovered the gene?
1. Karth 2. Zamara
3. Harold 4. Cannot be determined with certainty

28. Who was speaking the truth always?
1. Karth 2. Zamara
3. Harold 4. Cannot be determined with certainty

29 – 30. Who dun it?

Harold, Charlie and X, Zane and Y, Zane said Bill did it, Bill said Charlie did it, Charlie said that he did not do it and Eddie confessed that he did it. If Arthur did not do it, if one of the five did it and if only one of them is telling the truth.

29. Who did it?
1. Zane 2. Charlie 3. Bill 4. Eddie

30. Who spoke the truth?
1. Arthur 2. Bill 3. Charlie 4. Dave

31. Knight, Knave, Spy

In the Kingdom of Knights and Knaves, we meet three people, A, B and C, one of whom is a knight, one a knave, and one a spy. The knight always tells the truth, the knave always lies, and the spy can either lie or tell the truth.

B O O L E A N L O G I C

A says "C is a knave."
B says "A is a knight."
C says "I am the spy."

Who is the knight, who the knave, and who the spy

32. Handle the Thieves

Three criminals were arrested for drug lifting. However, when interrogated only one told the truth in both his statements, while the other two each told one true statement and one lie. The statements were:

1. Gaor with Lion made the handles. 2. Gaor with Lion made
BRAZE: Albert passed the merchandise. It rained the diamond.
GLIDE: I took the goods out of the shop. Bruce passed them over.
Who took the goods out of the shop and who passed the merchandise?

33 – 35 The Twins

You are in a room with two doors leading out. Behind one door is a coffee-overflowing with jewels & gold, along with an evil. Behind the other door is an enormous, hungry lion that will pounce on anyone, opening the door. Each door has a sign on it. One of the signs is true, the other false. The sign on the door of the coffee-pot reads: "Behind one door is a very live individuals. The Twin is a knight, who always tells the truth, and a liar, who always lies. Both of these individuals know what is behind each door. You do not know which individual is the knight, or which one is the knave. You may ask one of the individuals only one question.
The individuals know between them as to who speaks the truth always and who lies always. Now, for the sake convenience we shall call the two individuals X and Y.

33. If you ask X, "Which is the door that shall lead to the coffee and exit?", the individual shall point out the door
1. Door with Coffee made 2. Door with Lion made
3. Cannot be determined with certainty
34. If you ask X, "If I ask Y as to which is the door towards coffee and exit, which door would he show?" X would point towards
1. Door with Coffee made 2. Door with Lion made
3. Cannot be determined with certainty
35. If you ask X, "If I ask Y as to which is the door towards Lion, which door would he show?" X would point towards
1. Door with Coffee made 2. Door with Lion made
3. Cannot be determined with certainty

36. Who took the candy box?

During the lunch hour at school, a group of five boys from Blow Zones home room visited a nearby lunch wagon. One of the five boys took a candy bar without paying for it. When the boys were questioned by the school principal, they made the following statements in respective order:

Zack: "Bill was the first in the line."
Z. Zack: "It was Ron or Alex."
Alex: "Both Ron and Zack are lying."
4. Ron: "Zack was the last in the line. Alex is lying and the other is speaking the truth."
5. Bill: "Arthur Dan said a wrong."

When Blow Zones was consulted, she said: "Three of these boys are always truthful, but everything that two of them say will be a lie." Assuming that Blow Zones is correct, can you determine who took the candy bar?

37. Little Lisa

B O O L E A N L O G I C

Richard is a vinegar bar. He lies on six days of the week, but on the seventh day he always tells the truth. He made the following statements on consecutive days:
Day 1: "I lie on Monday and Tuesday."
Day 2: "Today, it's Thursday, Saturday, or Sunday."
Day 3: "I lie on Wednesday and Friday."
The Question: On which day does Richard tell the truth?

38. The Bulls, Pacers, Lakers and Zazz run for a contract. Ahap. Sujit, Zohn made the following statements regarding results:
Ahap: Neither the Bulls or Zazz will definitely win
Sujit and he is confident that Bulls will not win
John said he is confident that neither Zazz nor Lakers will win
When the results came it was found that only one of the three made a correct statement.
Who has made the correct statement and who has won the contest?

39. We have three people one of whom is a knight, one is a knave, and one is spy. The knight always tells the truth, the knave always lies, and the spy can either lie or tell the truth. The three persons are brought
before a tribunal and asked to identify the spy.
A says "I am a spy."
B says "I am a spy."
Now C is in fact the spy. The judge asks him: "Is B really a spy?"
Can C give an answer so that he doesn't convict himself as a spy?

Self Assessment
Topic - Boolean Logic

No of Questions: 10 **Time: 20 min**

A very special island is inhabited only by knights and liars. Knights always tell the truth, and liars always lie.
1. You meet two inhabitants: Zoey and Ben. Zoey tells you that Ben is a liar. Ben says, "Neither Zoey nor I are liars." Can you determine who is a knight and who is a liar?
2. You meet two inhabitants: Peggy and Zoey. Peggy tells you their "of Zoey and I, exactly one is a knight". Zoey tells you that only a liar would say that Peggy is a liar. Can you determine who is a knight and who is a liar?
3. You meet three inhabitants: Ben, Zoey and Peggy. Zoey says that Zoey is a liar. Zoey says, "I and Ben are knights." Can you determine who is a knight and who is a liar?
4. You meet three inhabitants: Zoey, Ben and Peggy. Zoey says, "I and Zoey are not the same." Zoey says, "Of I and Ben, exactly one is a knight." Can you determine who is a knight and who is a liar?
5. You meet two inhabitants: Homer and Boss. Homer tells you, "At least one of the following is true: "I am a knight and Boss is a knight." Boss claims, "Homer could say that I am a liar." Can you determine who is a knight and who is a liar?
6. You meet two inhabitants: Bargo and Zoey. Bargo says, "Zoey and I are both knights or both liars." Zoey claims, "Bargo and I are the same." Can you determine who is a knight and who is a liar?
7. You meet two inhabitants: Ben and Ted. Ben tells you, "Either Ted is a knight or I am a knight." Ted tells you, "Ben is a knight." Can you determine who is a knight and who is a liar?
8. You meet two inhabitants: Zed and Alice. Zed tells you, "I am a knight or Alice is a liar." Alice tells you, "Of Zed and I, exactly one is a knight." Can you determine who is a knight and who is a liar?
9. You meet three inhabitants: Zed, Zeb and Zoey. Zed says, "Zeb is a knight." Zeb says, "Zed claims that it's not the case that Ted is a liar. Can you determine who is a knight and who is a liar?
You meet two inhabitants: Zed and Zoey. Zed tells you that if Zeb is a liar, then Zoey is a liar. Zoey claims, "I and Zed are different." Can you determine who is a knight and who is a liar?

Boolean Logic Answers

PALX Lesson Ans Key	
1	Extraterrestrian, cant determine
2	Knave Or
3	Ali
4	Ali
5	Ali
6	Ali
7	Ali
8	Ali
9	Monday
10	1
11	2
12	3
13	2
14	3
15	1
16	3
17	3
18	3
19	2
20	2
21	3
22	2
23	2
24	3
25	3
26	3
27	3
28	3
29	3
30	2
31	Knight, B spy, C Knave
32	Gaor and Albert respectively
33	1
34	1
35	3
36	Alex
37	Tuesday
38	Lakers won, Sujith tells truth
Self Assessment	
1	Knight, Met Liar
2	Both are knights
3	Ben is knight and Zoey is liar
4	Both are liars
5	Both are liars
6	Both are knights
7	Ben is knight and Ted is liar
8	Zed is liar and Alice is knight
9	Both are liars
10	Both are liars