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Homework 6

(1) You cannot prove the Parallel axiom using the four other axioms because hyperbolic geometry satisfies axioms 1-4, but not the 5<sup>th</sup> axiom.

(2) If we think about the liar paradox: "This statement is false", we will notice that the statement would only be true when it is false. Because of this, the statement would neither be true nor false.

Now if we think about the statement: "this statement is unprovable", we are only able to say the statement is true if and only if the statement is unable to be proven. Therefore, the statement is true and unprovable.

(3) Every meaningful statement is either provable (if it is true) or disprovable (if it is false). The notion of the "Turing machine" is flawed, as well as the "halting problem".

"Does the program halt" is the same as saying  $\exists N \in \mathbb{Z}$  s.t. the program halts after  $N$  steps. It would be assumed that  $N$  can be anything i.e. taken over the infinite set of integers.

(4) (i) A: B is a lie-teller

B: A is a lie-teller.

Either A or B can be telling the truth; they cannot be both telling the truth nor lying at the same time.

(ii) A: B is a truth teller.

B: A is a lie-teller.

If A is telling the truth, B would be also telling the truth and there would be a contradiction.

If A is lying, B must also be lying, but he is seen telling the truth, so it would also be a contradiction.

(iii) A: B is a lie teller

B: C is a lie teller.

C: A is a lie teller.

- If A is telling the truth, B would be lying about C being a lie teller. C would then be telling the truth that A is lying which is a contradiction of our initial assumption.

- If A is lying, B would be telling the truth that C tells lies. C would then imply that A is a truth teller which is a contradiction of our initial assumption.

(iv) A: B is a lie teller

B: C is a lie teller

C: D is a lie teller

D: A is a lie teller

- Assume A is lying. B would then be telling the truth that C is a liar. C would be lying about D being a liar, which makes D telling the truth that A is a liar.

- Assume A is telling the truth. B is lying about C being a liar, making C telling the truth that D is a liar. D is lying about A being a liar, making A telling the truth.