

CSI30 - Proofs Summary

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↳ Direct proofs

↳ A chain of steps leading to the statement to prove, e.g.

We know A is true

Since $A \rightarrow B \rightarrow C \rightarrow \dots \rightarrow Z$

Z is true.

↳ A common strategy is to use cases, show all of them result in the statement to prove, then show they cover the entire domain.

↳ Contrapositives

↳ Showing $P \rightarrow Q$ by showing $\neg Q \rightarrow \neg P$

Remember to flip Q & P .

↳ Same strategies as direct proofs, but preceded by logic 'flipping' the statements, as it can be easier.

↳ Contradiction

↳ Assuming the opposite of the statement to prove, then show it results in contradiction.

↳ Again, a step preceding a direct proof to make the process easier.

↳ Non-constructive proofs.

↳ Constructive proofs demonstrate something exists by providing a method to create it.

↳ Non-constructive proofs show something exists, but don't provide a mechanism to create it.

↳ Modus ponens.

↳ If P implies Q , and P is true,
 Q is also true

↳ In algebraic terms:

$$\begin{aligned} & x \wedge (\neg x \vee y) \\ & \equiv (x \wedge y) \vee (x \wedge \neg x) \\ & = (x \wedge y) \vee F \\ & = x \wedge y \end{aligned}$$

(↳ Modus tollens)

↳ If P implies Q , and Q is false,
 P is also false.

↳ \approx Inverse of modus ponens.