Submission 1.2

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1 Arguments in English

	$P \vee M$	P_1
1	$\neg P$	P_2
	M	$DS(1,2)$

	$R \implies F$	P_1
	$F \implies \neg R$	P_2
4	$\neg F \implies \neg R$	$ContraPos(1)$
	$F \vee \neg F$	$Taut$
	$\neg R \vee \neg R$	$CD(2,3,4)$
	$\neg R$	Rep

	$C \implies P$	P_1
6	$\neg P$	P_2
	$\neg P \implies \neg C$	$ContraPos(1)$
	$\neg C$	MP

	$A \implies \neg G$	P_1
	$M \implies A$	P_1
7	$\neg\neg G \implies \neg A$	$ContraPos(1)$
	$G \implies \neg A$	DN
	$\neg A \implies \neg M$	$ContraPos(2)$
	$G \implies \neg M$	$HS(4,5)$

	$M \iff H$	P_1
	$M \wedge \neg H$	P_2
	M	$Simp(2)$
10	H	$DefOfEq(3)$
	$\neg H$	$Simp(2)$
	$H \vee E$	$Add(4)$
	E	$DS(5,6)$

	$O \iff E$	P_1
	$\neg H \implies \neg E$	P_2
	$H \implies \neg E$	P_3
12	$H \vee \neg H$	$Taut$
	$\neg E \vee \neg E$	$CD(2,3,4)$
	$\neg E$	Rep
	$\neg E \vee \neg O$	Add

	$M \implies \neg N$	P_1
	$\neg M \implies R$	P_2
13	$N \neg R$	P_3
	$\neg\neg N \implies \neg M$	$ContraPos(1)$
	$\neg M \wedge \neg\neg M$	

	$P \implies (F \implies E)$	P_1
	$\neg E$	P_2
14	$\neg P \vee (F \implies E)$	$CDis(1)$
	$\neg P \vee (\neg E \implies \neg F)$	$ContraPos(3)$
	$\neg P \vee \neg F$	$MP(2,4)$

	$L \implies Y$	P_1
	$\neg L \implies (S \vee R)$	P_2
	$\neg(S \vee R) \implies L$	$ContraPos(2)$
	$\neg(S \vee R) \implies Y$	$HS(1,3)$
15	$\neg\neg(S \vee R) \vee Y$	$CDis(3)$
	$(S \vee R) \vee Y$	$DN(4)$
	$R \vee (Y \vee S)$	$Commute \vee (5)$
	$\neg R \implies (Y \vee S)$	$CDis(6)$
	$\neg R \implies (\neg Y \implies S)$	$CDis(7)$

2 Claims

13 The statement $(A \wedge B) \wedge C$ is true if and only if A, B, and C are true. The statement $A \wedge (B \wedge C)$ is true if and only if B, C, and A are all true. Therefore, the statements $(A \wedge B) \wedge C$ and $A \wedge (B \wedge C)$ are equivalent.
The statement $(A \vee B) \vee C$ is false if and only if A, B, and C are false. The statement $A \vee (B \vee C)$ is false if and only if B, C, and A are all false. Therefore, the statements are equivalent.
$(F \implies T) \implies F$ is False, while $F \implies (T \implies F)$ is True. Therefore, $A \implies (B \implies C)$ and $(A \implies B) \implies C$ are equivalent.
The statement $(A \iff B) \iff C$ is true if and only if A, B, and C are all equivalent. (All either true or false.) The statement $A \iff (B \iff C)$ is true if and only if A, B, and C are all equivalent. Therefore, the two statements are equivalent.

18 The argument $\begin{array}{c} \text{A} \\ \text{B} \\ \hline \text{C} \end{array}$ will always be valid, because there is no case in which A and B will be true and C will be false, since there is no case in which C is false.

19 $(A \vee B) \iff A \iff B$, since $A \iff B$ (A and B are logically equivalent) and $(A \vee A) \iff A$.

20 $A \vee B$ is contingent, because both A and B are contingent.

21

A	B	$(\neg A \implies B)$	$A \vee B$
T	T	T	T
T	F	T	T
F	T	T	T
F	F	F	F

A	B	$\neg(A \implies \neg B)$	$A \wedge B$
T	T	T	T
T	F	F	F
F	T	F	F
F	F	F	F

A	B	$\neg((A \implies B) \implies \neg(B \implies A))$	$A \iff B$
T	T	T	T
T	F	F	F
F	T	F	F
F	F	T	T

22

A	B	$\neg(\neg A \vee \neg B)$	$A \wedge B$
T	T	T	T
T	F	F	F
F	T	F	F
F	F	F	F

A	B	$\neg A \vee B$	$A \implies B$
T	T	T	T
T	F	F	F
F	T	T	T
F	F	T	T

We have already Proven that $\implies$ and $\wedge$ are possible using this logical system, and $((A \implies B) \wedge (B \implies A))$ is equivalent to $A \iff B$, therefore $\iff$ exists in this logical system.