Exam 1 Study Guide

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1 Core Concepts

Explore the relations between these concepts: logically valid, logically sound, true/false premises, true/false conclusion, logically true/false/indeterminate premises/conclusions, logically inconsistent sets, logically equivalent sentences. For example:

1. If an argument is logically valid, must/can is be logically sound? Why? Must/can it have true/false premises? Why?
2. If an argument is logically sound, must/can it be logically valid? Must/can it have true/false premises?

2 Symbolize into SL

Recall how to create a symbolization key in sentential logic. Do not use PL. Refer to the table on p. 54 of The Logic Book for help translating the logical connectives. For example:

1. John goes to school only if John loves his mom.
2. John loves his mom if and only if either John goes to school or John doesn't love his mom.
3. John goes to school unless John loves his mom, but if John loves his dad, then John doesn't go to school.

3 Truth-tables in SL

Remember the rules for each connective. Be able to use truth-tables to test for truth-functional truth, truth-functional falsity, truth-functional indeterminacy, truth-functional consistency, truth-functional validity, and truth-functional equivalence. For example:

1. Is $((A \vee \sim A) \supset (B \equiv \sim B))$ truth-functionally true/false/indetermiante?

2. Is the argument from $(\sim A \supset D)$ and $(\sim B \supset (D \supset\sim D))$ to $(A \vee B)$ truth-functionally valid?

3. Are $((A \equiv B) \equiv\sim A)$ and $((A \supset B)\ \&\ (\sim B \supset A))$ truth-functionally equivalent?

4 Derivations in SL

Recall the rules for each connective. Be familiar with how to deal with DeMorgan, Modus Tollens, negated conditionals, negated disjunctions, and negated conjunctions. For example:

1. From $(A \vee B)$, $\sim A$, $((C \vee D) \supset\sim B)$ derive $\sim D$.

2. From $\sim A \supset D$, $(\sim B \supset (D \supset\sim D))$ derive $(A \vee B)$.

3. Show $(A \supset (\sim B \supset\sim (A \supset B)))$ is a theorem (i.e., prove it from no prior assumptions.)

5 Symbolize into PL

Recall how to create a symbolization key in PL. Focus on "every..." and "some" statements. For example:

1. Everyone with a good job is happy.

2. If every senior graduates, then either Anne isn't a senior or she graduates.

3. Everyone who reads Alice in Wonderland understands Green Eggs and Ham

4. No one who reads Alice in Wonderland and understands Green Eggs and Ham reads every book

5. (Challenge) Everyone who reads every book understands none of them

Exam 1 Study Guide Answers

§2. Symbolize into SL

S = John goes to school.
M = John loves his mom.
D = John loves his dad.

1) $S \supset M$

2) $M \equiv (S \vee {\sim}M)$

3) $(S \vee M) \,\&\, (D \supset {\sim}S)$

§3. Truth-tables in SL

1)

A	B	$(A \vee {\sim}A)$	$\supset$	$(B \equiv {\sim}B)$
T	T	t T f t	F	t F f t
T	F	t T f t	F	f F t f
F	T	f T t f	F	t F f t
F	F	f T t f	F	f F t f

truth-functionally false

→

2)

A	B	D	(~A	⊃	D)	[~B	⊃	(D ⊃ ~D)]			A	∨	B
T	T	T	f	T	t	f	T	t	F	f	t	T	t
T	T	F	f	T	f	f	T	f	T	t	t	T	t
T	F	T	f	T	t	t	F	t	F	f	t	T	f
T	F	F	f	T	f	t	T	f	T	t	t	T	f
F	T	T	t	T	t	f	T	t	F	f	f	T	t
F	T	F	t	F	f	f	T	f	T	t	f	T	t
F	F	T	t	T	t	t	F	t	F	f	f	F	f
F	F	F	t	F	f	t	T	f	T	t	f	F	f

↑ truth-functionally valid

3)

A	B	(A ≡ B)	≡	~A	((A ⊃ B)	&	(~B	⊃	A))
T	T	t	F	f	t	T	f	T	t
T	F	f	T	f	f	F	t	T	t
F	T	f	F	t	t	T	f	T	f
F	F	t	T	t	t	F	t	F	f

↑ <u>not</u> truth-functionally equivalent

§4 Derivations in SL

1	$A \vee B$	Ass.
2	$\sim A$	Ass.
3	$(C \vee D) \supset \sim B$	Ass.
4	D	A / ~I
5	$C \vee D$	4 ∨I
6	$\sim B$	3, 5 ⊃E
7	A	A / ∨E
8	$\sim B$	A / ~E
9	A	7 R
10	$\sim A$	2 R
11	B	8 - 10 ~E
12	B	A / ∨E
13	B	12 R
14	B	1, 7-11, 12-13 ∨E
15	$\sim D$	4 - 14 ~I

2)

1	$\sim A \supset D$	Ass.
2	$\sim B \supset (D \supset \sim D)$	Ass.
3	$\sim (A \vee B)$	A/~E
4	A	A/~I
5	$A \vee B$	4 ∨I
6	$\sim (A \vee B)$	3 R
7	$\sim A$	4-6 ~I
8	B	A/~I
9	$A \vee B$	8 ∨I
10	$\sim (A \vee B)$	3 R
11	$\sim B$	8-10 ~I
12	D	1, 7 ⊃E
13	$D \supset \sim D$	2, 11 ⊃E
14	$\sim D$	12, 13 ⊃E
15	$A \vee B$	3-14 ~E

3)

1	A	$A / \supset I$
2	$\sim B$	$A / \supset I$
3	$A \supset B$	$A / \sim I$
4	B	$1, 3 \supset E$
5	$\sim B$	$2R$
6	$\sim(A \supset B)$	$3-5 \sim I$
7	$\sim B \supset \sim(A \supset B)$	$2-6 \supset I$
8	$A \supset (\sim B \supset \sim(A \supset B))$	$1-7 \supset I$

§5 Symbolise into PL

1) $(\forall x)((Px \,\&\, Gx) \supset Hx)$

2) $(\forall x)(Sx \supset Gx) \supset (\sim Sa \vee Ga)$

3) $(\forall x)((Px \,\&\, Rxa) \supset Uxg)$

4) $\sim(\exists x)(((Px \,\&\, Rxa) \,\&\, Uxg) \,\&\, (\forall y)(By \supset Rxy))$

OR

$(\forall x)(((Px \,\&\, Rxa) \,\&\, Uxg) \supset \sim(\forall y)(By \supset Rxy))$

5) $(\forall x)((Px \,\&\, (\forall y)(By \supset Rxy)) \supset (\forall z)(Bz \supset \sim Uxz))$