§1. Well-formed Formulas

1. Not well-formed
2. $(\sim(\sim\sim A \vee (C \supset B)))$
3. Not well-formed
4. Not well-formed
5. Not well-formed
6. $((A \equiv (B \,\&\, (\sim C \equiv A))) \supset ((D \,\&\, A) \,\&\, \sim Z))$

§2. Translations into SL

1. P = Bob went to the park
   S = It was sunny outside
   C = It was partly cloudy outside

   $(P \supset (S \vee C))$

2. S = Sue loves going to the movies
   J = Jim loves going to the movies
   X = Sue has gone to the movies recently
   Y = Jim has gone to the movies recently

   $((S \,\&\, J) \,\&\, \sim(X \vee Y))$

3. A = Adam eats an apple
   E = Eve gives Adam an apple.

   $(A \supset E)$

4. Y = You'll get an A in this course

R = You do all the readings

S = You skip at least one lecture

$((R \,\&\, \sim S) \supset Y)$

5. S = That kid will get a stomach ache

M = That kid takes some medicine

$((S \vee M) \,\&\, \sim S)$

6. B = Bob loves Sue

I = Sue is indifferent

M = Bob is in a good mood.

$((B \equiv I) \vee \sim M)$

7. O = John orders orange juice at the diner

M = John orders milk at the diner

C = John just needs one cup

$(((O \vee M) \,\&\, \sim (O \,\&\, M)) \supset C)$

8. H = I hate it when it rains

R = It rains sometimes

$(H \,\&\, \sim R)$

9. Y = The Yankees will win the big game tonight

R = The Red Sox will win the big game tonight

P = The Yankees' plane crashes on the way

C = The Red Sox's plane crashes on the way

$((Y \vee R) \vee (P \& C))$

Also OK: $(((Y \vee R) \& \sim(Y \& R)) \vee (P \& C))$

10. W = The street is wet because it rained last night.

W

§3. Truth-tables

1.

A	A	≡	(~A ⊃ A)
T	T	T	F T T T
F	F	T	T F F F

truth-functionally true

2.

A	B	~(A & ~B)	∨	(A ≡ B)
T	T	T T F F T	T	T T T
T	F	F T T T F	F	T F F
F	T	T F F F T	T	F F T
F	F	T F F T F	T	F T F

truth-functionally indeterminate

3.

A	B	(B ⊃ ~~B)	∨	(~A & ~~A)
T	T	T T T T T	T	F T F T F T
T	F	F T F T F	T	F T F T F T
F	T	T T T F T	T	T F F F T F
F	F	F T F T F	T	T F F F T F

truth-functionally true

4.

A	B	C	((A ⊃ (B ≡ (~C ≡ A)))	∨	((C & A) & ~B))
T	T	T	T F T T F F T T	F	T T T F F F T
T	T	F	T T T T F T T	T	F F T F F T
T	F	T	T T F T F T F T	T	T T T T T F
T	F	F	T F F F T F T T	F	F F T F T F
F	T	T	F T T T F T T F	T	T F F F F T
F	T	F	F T T F T F F F	T	F F F F F T
F	F	T	F T F F F T T F	T	T F F F T F
F	F	F	F T F T T F F F	T	F F F F T F

truth-functionally indeterminate

5.

A	B	(((A ⊃ B) ⊃ (B ⊃ A))	⊃	(~A ≡ ~B))
T	T	T T T T T T T	T	F T T F T
T	F	T F F T F T T	F	F T F T F
F	T	F T T F T F F	T	T F F F T
F	F	F T F T F T F	T	T F T T F

truth-functionally indeterminate

§4. Putting it All together

1. C = Mary will buy a nice car

   B = Mary gets a big bonus

   P1. $B \supset C$

   P2. $\sim B$

   C. $\sim C$

B	C	$B \supset C$	$\sim B$	$\sim C$
T	T	T	F	F
T	F	F	F	T
F	T	T	T	F
F	F	T	T	T

truth-functionally invalid

2. T = The grocery store is open on Tuesday

   W = The grocery store is open on Wednesday

   A = Sue will buy apples

   P1. $(T \vee W) \,\&\, \sim(T \,\&\, W)$

   P2. $T \supset A$

   P3. $W \supset \sim A$

   C. $A \vee W$

T	W	A	(T ∨ W)	&	~	(T & W)	T	⊃	A	W	⊃	~	A	A	∨	W
T	T	T	T	F	F	T	T	T	T	T	F	F	T	T	T	T
T	T	F	T	F	F	T	F	F	F	T	T	T	F	T	T	F
T	F	T	T	T	T	F	T	T	T	F	T	F	T	T	T	T
T	F	F	T	T	T	F	F	F	F	F	T	T	F	F	F	F
F	T	T	T	T	T	F	T	T	T	T	F	F	T	T	T	T
F	T	F	T	T	T	F	T	F	F	T	T	T	F	F	T	F
F	F	T	F	F	T	F	T	T	T	F	T	F	T	T	T	T
F	F	F	F	F	T	F	T	T	F	F	T	T	F	F	F	F

No counterexample, so truth-functionally valid

3. Y = The Yankees win the big game

R = It's raining

U = The temperature is over 90 degrees

P1. $Y \equiv \sim R$

P2. $R \supset U$

C. $Y \supset \sim U$