Solutions: §1.1. 2, 4, 6, 7

2. a. Let $J :=$ John is telling the truth and $B :=$ Bill is telling the truth. Then the statement can be written: $(J \land B) \lor (\neg J \land \neg B)$

b. Let $F :=$ I’ll have the fish. Let $C :=$ I’ll have the chicken and let $M :=$ I’ll have the mashed potatoes. Then the statement can be written: $(F \lor C) \land \neg(F \land M)$.

c. Let $D(x, y) := x$ divides $y$. Then the statement can be written: $D(3, 6) \land D(3, 9) \land D(3, 15)$.

4. a) and c) are well formed statements. b) is not because of the commas and d) is not because there is no connective between the two parantheses.

6. Please note, as I explained in class, there are many ways to express these logical statements in English.

a. Either Steve is happy and George is unhappy, or George is happy and Steve is unhappy.

b. Either Steve or George is happy or unhappy.

c. Either Steve is happy or George is happy.

7. a. Hypotheses:

1. Jane and Pete won’t both win the math prize.

2. Pete will win either the math prize or the chemistry prize

3. Jane will win the math prize

Conclusions:

1. Pete will win the chemistry prize.

If we let $J_M :=$ Jane will win the math prize, $P_M :=$ Pete will win the math prize, $J_C :=$ Jane will win the chemistry prize, $P_C :=$ Pete will win the chemistry prize, then the argument looks like:

Hypotheses:

1. $\neg(J_M \land P_M)$

2. $P_M \lor P_C$

3. $J_M$

Conclusions:

1. $P_C$

The reasoning is, in fact, valid.

b. Hypotheses:

1. The main course will be either beef or fish
2. The vegetable will be either peas or corn.

3. We will not have both fish as a main course and corn as a vegetable

Conclusions:

1. We will not have both beef as a main course and peas as a vegetable.

If we let $B :=$ The main course will be beef, $F :=$ The main course will be fish, $P :=$ The vegetable will be peas, $C :=$ The vegetable will be corn, then the argument looks like:

Hypotheses:

1. $B \lor F$
2. $P \lor C$
3. $\neg(F \land C)$

Conclusions:

1. $\neg(B \land P)$

The reasoning is not valid.

c. Hypotheses:

1. Either John or Bill is telling the truth.
2. Either Sam or Bill is lying

Conclusions:

1. Either John is telling the truth or Sam is lying.

If we let $J :=$ John is telling the truth, $B :=$ Bill is telling the truth and $S :=$ Sam is lying, then the argument looks like:

Hypotheses:

1. $J \lor B$
2. $\neg S \lor \neg B$

Conclusions:

1. $J \lor \neg S$

The reasoning is, in fact, valid.

d. Hypotheses:

1. Either sales will go up and the boss will be happy, or expenses will go up and the boss will be unhappy.

Conclusions:
1. Sales and expenses will not both go up.

If we let $S :=$ Sales will go up, $E :=$ Expenses will go up, and $B :=$ The boss will be happy, then the argument looks like:

Hypotheses:

1. $(S \land B) \lor (E \land \neg B)$

Conclusions:

1. $\neg (S \land E)$

The reasoning is not valid.