Solutions 6

Excercise 1: Translation into statement logic
- Translate the following English sentences into statement logic. Use lower case letters for atomic statements and provide the "key" to your translation, i.e., say which atomic symbols correspond to which English sentences.

(1)   a.   Either John is in that room, or Mary is, and possibly they both are.
         trans: $(j \vee m)$
         key: j: "John is in that room."; m: "Mary is in that room."

      b.   The fire was set by an arsonist, or there was an accidental explosion in the boiler room.
         trans: $((a \vee e) \wedge (\neg(a \wedge e)))$
         key: a: "The fire was set by an arsonist."; e: "There was an accidental explosion in the boiler room."

      c.   When it rains, the streets get wet.
         trans: $(r \rightarrow w)$
         key: r: "It rains."; w: "The streets get wet."

      d.   Sam wants a dog, but Alice prefers cats.
         trans: $(s \wedge a)$
         key: s: "Sam wants a dog."; a: "Alice prefers cats."

      e.   If Steve comes home late and has not had any supper, we will reheat the stew.
         trans: $((l \wedge (\neg s)) \rightarrow r)$
         key: l: "Steve comes home late."; s: "Steve had supper."; r: "We will reheat the stew."

      f.   Clarence is well educated only if he can read Chuvash.
         trans: $(e \rightarrow r)$
         key: e: "Clarence is well educated."; r: "Clarence can read Chuvash."

      g.   Marsha won't go out with John unless he shaves his beard and stops drinking.
         trans: $(g \rightarrow (s \wedge (\neg d)))$
         key: g: "Marsha goes out with John."; s: "John shaves his beard."; d: "John drinks."

      h.   The stock market advances when public confidence in the economy is rising and only then.
         trans: $(r \leftrightarrow a)$
         key: r: "Public confidence in the economy is rising."; a: "The stock market advances."

      i.   A necessary but perhaps not sufficient condition for negotiation to commence is for Barataria to cease all acts of agression against Titipu.
         trans: $(n \rightarrow (\neg a))$
         key: n: "Negotiations commence."; a: "Barataria acts agressively against Titipu."

Excercise 2: Translation and ellipsis

- The following sentences contain various sorts of ellipsis, so that some of the connectives appear not to be connecting whole statements. Translate them into statement logic (by paraphrasing them by non-elliptic English versions first).

(2)   a.   John and Bill are going to the movies, but not Tom.
          para: John and Bill are going to the movies, and Tom is not going to the movies.
          trans: $(m \land (\neg t))$
          key: m: "John and Bill are going to the movies."; t: "Tom is going to the movies."

        b.   Susan doesn't like squash or turnips.
          para: Susan doesn't like squash and Susan doesn't like turnips.
          trans: $((\neg s) \land (\neg t))$
          key: s: "Susan likes squash."; t: "Susan likes turnips."

        c.   If neither Peter nor Fred is going to the party, then neither will I.
          para: If neither Peter is going to the party nor Fred is going to the party, then neither will I go to the party.
          trans: $((\neg(p \lor f)) \to (\neg i))$
          key: p: "Peter is going to the party."; f: "Fred is going to the party."; i: "I am going to the party."

        d.   If Mary hasn't gotten lost or had an accident, she will be here in five minutes.
          para: If Mary hasn't gotten lost and Mary didn't have an accident, then she will be here in five minutes.
          trans: $(((\neg l) \land (\neg a)) \to h)$
          key: l: "Mary has got lost."; a: "Mary had an accident."; h: "Mary will be here in five minutes."

        e.   A bear or a wolf frightended the boys.
          para: Either a bear frightened the boys, or a wolf frightened the boys.
          trans: $((b \lor w) \land (\neg(b \land w)))$
          key: b: "A bear frightened the boys."; w: "A wolf frightened the boys."
          note: $(b \lor w)$ is not excluded but seems pragmatically less plausible.

        f.   A party or a softball game would have amused the children.
          para: A party would have amused the children and a softball game would have amused the children.
          trans: $(p \land s)$
          key: p: "A party would have amused the children."; s: "A softball game would have amused the children."

Excercise 3: Computing truth values

- Let p, q and r be True, and let s be False. Find the truth values of the following statements.

(3)   a. $((p \land q) \land s)$: False
        b. $(p \land (q \land s))$: False
        c. $(p \to s)$: False
        d. $(s \to p)$: True
        e. $((p \land q) \leftrightarrow (r \land (\neg s)))$: True
        f. $(p \to (q \leftrightarrow (r \to s)))$: False