Exercise 1. Sahlqvist algorithm.
Compute the standard translation and a first order correspondent of (some of) the following formulas. For (6)-(8) Exercise 2 could be helpful.

(1) □□p → □p
(2) □p ∧ p → ◊◊p
(3) ◊□p → □◊p
(4) ◊□p → □◇◊p
(5) ◊p ∧ ◊q → (◇(p ∧ q) ∨ ◇(p ∧ q) ∨ ◇(q ∧ ◇p))
(6) □((□p ∧ p) → ◊◊p)
(7) □((□p → p) ∨ (◇p → □□p))
(8) □(□p → q) ∨ □(□q → p)
(9) q → □F□Rpq (a temporal example; can you think how to do it?)

Exercise 2 (3.6.3 in Blackburn et al.).

(1) Prove that if φ → ψ and φ' → ψ' are simple Sahlqvist formulas, then (φ → ψ) ∨ (φ' → ψ') is equivalent to a simple Sahlqvist formula.
(2) Show that if φ and α(x) locally correspond, so do □φ and ∀y(Rxy → α(y)).
(3) Prove that if φ (locally) corresponds to α(x) and ψ (locally) corresponds to β(x), then φ ∧ ψ (locally) corresponds to α(x) ∧ β(x).
(4) (*) Show that if φ locally corresponds to α(x), ψ locally corresponds to β(x), and φ and ψ have no proposition letters in common, then φ ∨ ψ locally corresponds to α(x) ∨ β(x).
(5) (*) Prove that (2) and (4) do not hold for global correspondence, and that the condition on the proposition letters in (4) is necessary as well. (Hint: for (2), think of the modal formula ◊◇p → ◇p and the first-order formula ∀xyz(Rxy ∧ Ryz → Rxz).)