5.12:

a. ΠhotelNo, hotelName, city(Hotel);

{H | Hotel(H)};

{hNo, hName, city | (Hotel(hNo, hName, city)};

b. σprice < 20(Room) ꓵ σtype = ‘SINGLE’(Room);

{R | Room(R) **Λ R.type = ‘SINGLE‘ Λ R.price < 20};**

{rNo, hNo, type, pr | (Room(rNo, hNo, type, pr) **Λ type = ‘SINGLE‘ Λ pr < 20)};**

c. ΠguestName,guestAddress (Guest);

{G.guestName, G.guestAddress | Guest(G)};

{gN, gAdd | (∃ gNo) (Guest(gNo, gN, gAdd))};

d. Πtype, price (Room ▷ Room hotelNo = Hotel hotelNo(σhotelName = ‘Grosvenor Hotel’(Hotel)));

{R.type, R.price | Room(R) **Λ** (∃ H)(Hotel(H) **Λ (H.hotelName = ‘Grosvenor Hotel‘) Λ (H.hotelNo = R.hotelNo))};**

{type, pr | (∃ hN, hNo1, city) (Room(rNo,hNo, type, pr) **Λ Hotel(hNo1, hName, city) Λ (hNo = hNo1) Λ city = ‘Grosvenor Hotel‘)};**

e. ΠguestNo, guestName,guestAddress(Guest ▷ Guest guestNo = Booking guestNo(σdateFrom < current\_date(Booking) ꓵ σdateTo > current\_date(Booking)) ꓵ Booking ▷ Booking hotelNo = Hotel hotelNo (σhotelName = ‘Grosvenor Hotel’(Hotel)));

{G.guestNo, G.guestName, G.guestAddress | Guest(G) **Λ (**(∃ B)( ∃ H) (Booking(B) **Λ Hotel(H) Λ (G.guestNo = B.guestNo) Λ (B.hotelNo = H.hotelNo) Λ (B.dateFrom < current\_date) Λ (B.dateTo > current\_date) Λ H.hotelName = ‘Grosvenor Hotel‘))};**

{gNo, gName, gAdd | **(**∃ gNo1, hNo, hNo1, hName, dFrom, dTo) (Guest (gNo, gName, gAdd) **Λ Booking (hNo1, gNo1, dFrom, dTo, rNo) Λ Hotel (hNo, hName, city) Λ (gNo = gNo1) Λ (hNo1 = hNo) Λ (dFrom < current\_date) Λ (dTo > current\_date) Λ hName = ‘Grosvenor Hotel‘)};**

f. (ΠroomNo, hotelNo, type, price(Room ▷ Room hotelNo = Hotel hotelNo(σhotelName = ‘Grosvenor Hotel’(Hotel))) ⟕ (ΠguestName,(Guest));

g. ΠguestNo, guestName,guestAddress(Guest ▷ Guest guestNo = Booking guestNo(Booking) ꓵ Booking ▷ Booking hotelNo = Hotel hotelNo (σhotelName = ‘Grosvenor Hotel’(Hotel)));

{G.guestNo, G.guestName, G.guestAddress | Guest(G) **Λ (**(∃ B)( ∃ H) (Booking(B) **Λ Hotel(H) Λ (G.guestNo = B.guestNo) Λ (B.hotelNo = H.hotelNo) Λ H.hotelName = ‘Grosvenor Hotel‘))};**

{gNo, gName, gAdd | **(**∃ gNo1, hNo, hNo1, hName) (Guest (gNo, gName, gAdd) **Λ Booking (hNo1, gNo1, dFrom, dTo, rNo) Λ Hotel (hNo, hName, city) Λ (gNo = gNo1) Λ (hNo1 = hNo) Λ hName = ‘Grosvenor Hotel‘)};**