Q1:

a) $p(a_1, a_2, \ldots, a_T, b_1, b_2, \ldots, b_T, x_1, x_2, \ldots, x_T)$

$= p(b_1)\, p(a_1|b_1) \prod_{i=2}^{T} p(b_i|b_{i-1}) \prod_{i=2}^{T} p(a_i|a_{i-1}, b_i) \prod_{i=1}^{T} p(x_i|b_i)$

b) $O(T)$. Since when we proceed to do the elimination, we would have $O(T)$ factors with the form of conditional probability w.r.t. a_i & b_i for $t=1, \ldots, T$.

c) No

d) Yes

e) Yes

f) No

g) Yes

h) Yes