本考科禁用計算機

1. (15%) A student is to answer 7 out of 10 questions in an examination.
   (a) (5%) How many choices has she?
   (b) (10%) How many if she must answer at least 3 of the first 5 questions?
2. (15%) Solve the recurrence: $C_N = C_{N/2} + 1$.
3. (15%) For A = {a, {a},{a,b},{}}, determine the following sets:
   (a) (5%) A – {a}
   (b) (5%) {a, b, c} – A
   (c) (5%) (A ∪ {a, b}) ∩ {{}}
4. (15%) Let G be a simple graph with smallest number of vertices such that (1) the total degrees of G are exactly 240 and (2) all vertices of G have the same degree. How many vertices G has?
5. (20%) Let $I = O = \{0, 1\}$. Please construct a state diagram for a finite state machine that recognizes each occurrence of 0110 in a string x which is in I (Here overlapping is allowed).
6. (10 %) Prove or disprove that $a \equiv (3 \bmod 4)$ cannot have a prime factor $b \equiv 1 \pmod 4$.
7. (10%) Find a graph G where both G and G' are connected.