Hints – Online Programming Contest, Shaastra 2011

Square Coloring
Notice that you can construct of board size 2^(n+1) from a board of size 2^n. This leads to an O(log N) solution. Alternatively, the problem can be reduced to a nim game.
The answer is just X ^ Y.

Number Game
The answer is independent of the choice of moves by the players. It depends only on the numbers chosen in the beginning. The final value is always a constant and is equal to $\Sigma A_i - (n * (n - 1) / 2$.
Time complexity is O(N).

Fortune
The nth term of the sequence is 2^(2^n) which needs to be calculated modulo k.
Using Euler's theorem, 2^(2^n) is congruent to 2^ (r) where r = 2 ^ n modulo phi(k).
All the quantities can be calculated in O(log N) time.

Subset Sum
The expected math problem of the contest.
The answer is the coefficient of x^k in (1 + x)(1 + x^2) … (1 + x^n)
If n = 2, the answer is 2^(n-1).
Otherwise, the answer is ((2^(n/k))* (k-1) + 2^n) / k. Use nth roots of unity or google it.

Packing Chemicals
- Bounded knapsack can be reduced to 0-1 knapsack. 10 items of a particular type is equivalent to 1, 2, 4, 3 of that type with the values and costs suitably multiplied.
- Even after this reduction, the number of items will be 40. To get around this, split the items into two groups. Find the all possibilities in each group and merge them.
- O (K log K) where K = 2 ^ (n/2 * log2(15))

Pattern Recognition
- Construct the suffix array of the string and compute the longest common prefix between every two suffixes.
- The problem reduces to finding a range of contiguous integers whose minimum is at least the “K” and the index “M” belongs to that range. We can use range minimum query with a sparse table approach for this.
- Expected complexity : O(N * log N)