**Question 1**

**(a) Average number of array locations to inspect to find the first D**

Sample space is A,B,C,D. Selection of an array location is an independent event.

Therefore, probability, p of getting a D is **¼.**

Expected (Average) of trials for success, **S** = **1/p**. *(Slide 13, Probability)*

Average number of locations to find first D = 1/(¼) = 4

**(b) Average number of array locations to inspect to find 10 D’s**

Expected number (average number) of trials for k successes = **k/p** *(Slide 15, Probability)*

Average number of array locations to inspect to find 10 D’s = 10/(1/4) = 40

(c) **“Average time complexity” to find k D’s in an array**

Average time complexity is the same as the average number of steps taken to get k successes.

Therefore, average time complexity is **k/p = k/(1/4) = 4k = O(n)**

**Question 2:**

Prove: 1 + 1/2 + 1/3 + ...+ 1/n = O(log n)

**Hint:n=7**

1+1/2+1/3+1/4+1/5+1/6+1/7 <= 1+1/2+1/2+1/4+1/4+1/4+1/4 = 3 = log(7+1)

**If n=15**

1+1/2+1/3+.....+1/15 <= 1+1/2+1/2+1/4+1/4+1/4+1/4+1/8+1/8+1/8+1/8+1/8+1/8+1/8+1/8 = 4 = log(15+1)

**If n=31**

1+1/2+1/3+.....+1/31 <= 1+1/2+1/2+1/4+1/4+1/4+1/4+1/8+1/8+1/8+1/8+1/8+1/8+1/8+1/8 +1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16+1/16 =5 = log(31+1)

Hence for n1 + 1/2 + 1/3 + ...+ 1/n <= log(n+1) = O(log n)

**Question 3**

S/2 = a/(1-r)

S/2 = (1/2)/(1-1/2)

S/2 = (1/2)/(1/2)

S/2 = 1

S = 2