

Practice Questions for Apr 29, 2019 (more questions may be added later)

1. Suppose we fill the 16 entries of a 4x4 relation matrix R in some order by tossing a coin 16 times, where we take an entry to be 1 or 0 according to getting H or T in the toss. Assume that $\text{Prob}(H) = p$ and $0 < p < 1$.
 - (i) What is the probability that we get a symmetric relation?
 - (b) Give the ratio $\#(\text{Symmetric relations on 4 items})/\#(\text{all relations on 4 items})$.
 - (c) Give all details to show that the probability in (i) can never be less than the ratio in (ii).
 - (d) When can the probability in (i) equal the ratio in (ii)?
 - (e) What is the probability that the following code for testing the symmetry-property of a 4x4 matrix obtained above will return false value in 1st iteration of line 3?

```
for (int i=0; i<4; i++)  
    for (int j=i+1; j<4; j++)  
        if (R[i][j] != R[j][i]) return(false);  
return(true);
```

Give the probability of false return-value in 2nd iteration of line 3.

Give the probabilities of other cases of false return-value and true return-value.

Show that all these probabilities add to 1.

Give the probability that the code takes 3 or more iterations of line 3, i.e., does not return a value in 1st iteration or 2nd iteration.