Midterm– probability – Schneider

Answers are in bold

1. (17 points) Write down the number of possibilities in the following problems (you can leave in symbolic form with numbers in correct places)
   - **a.** The number of different letter arrangements from **tessellate—10!/(3!*2!*2!*2!)--formula**
   - b. How many different 5 card poker hands can you get where one of the cards must be the ace of spades.—**51 choose 4 as can use any of other 51 cards**
   - c. How many different subsets of an 8 element set are there if you don't count the empty set or the whole set. – **2**8 -2 as don't count empty or whole set**
   - d. You have 16 people in a class. How many ways can they line up for lunch?—**16!**
   - e. What is the coefficient of x^{11} in the expansion of $(x+1)^{50}$--- **50 choose 11**
2. (17 points)Two symmetric dice have had three of their sides painted red, two painted black, and one painted yellow. When this pair is rolled what is the probability that both dice land with the same color face up**.(3*3+2*2+1)/36**
3. (17 points) Suppose for the two events A, B we know P(A|B)=.2; P(B)=.4; and $P(AB^c)$=.2. Find P(B|A**).—use that P(A)=P(AB^c) +P(AB) and P(AB)=P(A|B)*P(B) and P(B|A)= P(AB)/P(A) and you have all numbers.**
4. (17 points) Prove that if P(AB) = P(A)P(B) then $P(A^cB)= P(A^c)P(B)$ **.—done in class notes**
5. (17 points) Urn A contains 2 red and 8 black balls. Urn B contains 8 red and 2 black balls. Bob picks a black ball from urn A and a red ball from urn B. The balls are not replaced and Jane follows Bob and picks a ball from each urn. What is the probability that Jane picks different color balls.—**After Bob picks there are 2 red and 7 black in urn A and 7 red and 2 black in urn B. Jane can pick RB and BR with probabilities (2*2 +7*7)/81**
6. (17 points) You have a normal 52 card deck. Note that your hand does not depend on order. You are dealt two cards.
   - **a.** In how many ways can you be dealt a two card hand.—**52 choose 2.**
   - **b.** What is the probability you will get two aces**.—(4*3)/(52*51) using order (but same with combinations)**
   - **c.** What is the probability you will get at least one ace.—**1- probability of getting no aces. The probability of getting no aces is (48*47)/(52*51). The answer is thus 1-(48*47)/(52*51).**
   - **d.** What is the conditional probability that you will have two aces given that you have one ace.—**You could interpret this in two ways and I gave credit for both.**

i. **If this means given at least one ace you get two aces then it is the (answer in (b))/(answer in (c)) from our formula for conditional probability where you notice that the probability of two aces and at least one ace is the probability of two aces.**
ii. **If this is the conditional probability given that the first card was an ace then the answer is 3/51 as there are 3 aces remaining out of the 51 cards you can use.**

7. (17 points) Maria will take two books with her on a trip. Suppose that the probability that she will like book 1 is .6, the probability that she will like book 2 is .5 and the probability that she will like both books is .4. Find the conditional probability that she will like book 2 given that she did not like book 1. –**B1 means like book 1, B2 means like book 2. P(B1)=.6;P(B2)=.5;P(B1B2)=.4. To find**

$$P(B2|B1^c)=P(B1^c\ B2)/P(B1^c)$$

But
$P(B1^c\ B2)$ =P(B2)-P(B1B2)= .1 and $P(B1^c)$= 1-P(B1)=.4.