#7 Midterm

Pair

$4 \times 13 = 52$

4 cards picked from 52 cards

$_{52}C_4$

To get a pair we need to pick one value from 13 cards

$_{13}C_1$

To get 2 of that value we need to pick twice out of the 4 seperate hands

$_4C_2$

Now we must pick 2 more cards that are not like our pair

$_{12}C_2$

Now we must choose a suit for each rank

$_4C_1 \cdot {_4C_1} = (_4C_1)^2$

$$\frac{_{13}C_1 \; _4C_2 \; _{12}C_2 \; {_4C_1}^2}{_{52}C_4}$$

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$$_nC_r = \frac{n!}{r!\,(n-r)!}$$

$$\frac{\frac{13!}{1!\,12!} \cdot \frac{4!}{2!\,2!} \cdot \frac{12!}{2!\,10!} \cdot \left(\frac{4!}{1!\,3!}\right)^2}{\frac{52!}{4!\,48!}}$$

$$\frac{13 \cdot 6 \cdot 66 \cdot 4^2}{\frac{52 \cdot 51 \cdot 50 \cdot 49}{4 \cdot 3 \cdot 2 \cdot 1}}$$

$$\frac{82368}{270725} = .30$$

Two Pair

We want two values from the 13 cards

$$_{13}C_2$$

For these pairs we want 2 different suits from the 4

$$(_4C_2)^2$$

$$\frac{_{13}C_2\,(_4C_2)^2}{_{52}C_4}$$

$$= \frac{78 \cdot (6)^2}{270725} = .104$$

3 of a kind

We want one value from the 13 cards

$_{13}C_1$

To get the 3 values we must pick from the 4 seperate hands

$_{4}C_3$

Now the last card must be picked that's not the same as the 3 of a kind

$_{12}C_1$

Now we must choose a suit

$_{4}C_1$

$$\frac{_{13}C_1 \, _{4}C_3 \, _{12}C_1 \, _{4}C_1}{_{52}C_4}$$

$$\frac{13 \cdot 4 \cdot 12 \cdot 4}{270,725} = \frac{2496}{270,725} = .0092$$

4 of a Kind

we want one value from the 13 in the deck

$_{13}C_1$

We want to get that value from each hand

$_4C_4$

$$\frac{13}{270725} = .000048$$

In my simulation I have a probability of having the same set of cards while in the calculation the sets of cards are unique.