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Started on Saturday, February 20, 2021, 4:04 PM

State Finished

Completed on Saturday, February 20, 2021, 4:09 PM

Time taken 4 mins 58 secs

Information

Did you complete the [Practice for Week 4 Activity](#) first? The practice is not graded and can ensure you understand how to do the calculations!

For this Activity you get 2 attempts. It is extremely important that you do not hit the back arrow icon on your browser to try to re answer a question/look at old answers, as it will count this as your second attempt!!!

As you go through the questions, **keep a record of your answers in a separate document** for reference, so that when you start your second attempt at the Activity, you can know what you answered before!

Part 1: Calculating Genotype Frequencies and RMP

Do the calculations and answer the questions on the following slides.

You may find it helpful to record your answers to each question as they may be useful for answering later questions.

Question 1

Correct

Points out of 1.00

Here is an example using 3 CODIS STR results. DNA evidence was found at a crime scene. Due to the poor quality of the DNA sample, only 3 of the 13 CODIS STRs could be determined. The table below lists the analytical results for the three STRs in the second and third columns (Allele A and Allele B).

STR Locus	Allele A	Allele B	P(Allele A)	P(Allele B)
D3S1358	11	12	0.5	0.2
TH01	4	4	0.5	0.5
D21S11	7	10	0.1	0.5

Which STR is homozygous for the DNA evidence? Recall that homozygosity means that for a given locus, an individual has 2 identical alleles.

Select one:

- ☒ a. TH01
- ☐ b. D3S1358
- ☐ c. D21S11



Question 2

Correct

Points out of 1.00

STR Locus	Allele A	Allele B	P(Allele A)	P(Allele B)
D3S1358	11	12	0.5	0.2
TH01	4	4	0.5	0.5
D21S11	7	10	0.1	0.5

In this table, the probabilities for the DNA evidence's alleles have already been established based on population frequencies in the CODIS database and are presented in the 2 far right columns.

Based on the probabilities (i.e. frequencies) for the various alleles for all 3 STRs, which allele is the rarest in the source population?

Select one:

- ☒ a. Allele 7 in D21S11
- ☐ b. Allele 4 at TH01
- ☐ c. Allele 10 at D21S11
- ☐ d. Allele 11 at D3S1358
- ☐ e. Allele 12 at D3S1358



Question 3

Correct

Points out of 1.00

STR Locus	Allele A	Allele B	P(Allele A)	P(Allele B)
D3S1358	11	12	0.5	0.2
TH01	4	4	0.5	0.5
D21S11	7	10	0.1	0.5

And the most common allele(s)?

Select one:

- ☒ a. Allele 11 at D3S1358, Allele 4 at TH01, and Allele 10 at D21S11
- ☐ b. Allele 4 at TH01
- ☐ c. Allele 11 at D3S1358
- ☐ d. Allele 7 at D21S11
- ☐ e. Allele 12 at D3S1358



Question 4

Correct

Points out of 1.00

STR Locus	Allele A	Allele B	P(Allele A)	P(Allele B)
D3S1358	11	12	0.5	0.2
TH01	4	4	0.5	0.5
D21S11	7	10	0.1	0.5

To calculate the RMP, we must first calculate the combined probabilities, or the genotype frequency, at each locus. Recall that the calculations for heterozygous ($2pq$) and homozygous (p^2) genotypes differ.

What is the genotype frequency for D3S1358? Write your answer as a decimal.

Answer: 0.2



Question 5

Correct

Points out of 1.00

STR Locus	Allele A	Allele B	P(Allele A)	P(Allele B)
D3S1358	11	12	0.5	0.2
TH01	4	4	0.5	0.5
D21S11	7	10	0.1	0.5

To calculate the RMP, we must first calculate the combined probabilities, or the genotype frequency, at each locus. Recall that the calculations for heterozygous and homozygous genotypes differ.

Now calculate the genotype frequency for TH01. Write your answer as a decimal.

Answer: 0.25



Question 6

Correct

Points out of 1.00

STR Locus	Allele A	Allele B	P(Allele A)	P(Allele B)
D3S1358	11	12	0.5	0.2
TH01	4	4	0.5	0.5
D21S11	7	10	0.1	0.5

To calculate the RMP, we must first calculate the combined probabilities, or the genotype frequency, at each locus. Recall that the calculations for heterozygous and homozygous genotypes differ.

Now calculate the genotype frequency for D21S11. Write your answer as a decimal.

Answer: 0.1



Question 7

Correct

Points out of 1.00

STR Locus	Allele A	Allele B	P(Allele A)	P(Allele B)
D3S1358	11	12	0.5	0.2
TH01	4	4	0.5	0.5
D21S11	7	10	0.1	0.5

Finally, we want to know what the probability is for a random individual to have these 3 genotypes simultaneously for the 3 STR loci found in the DNA sample—in other words we want to calculate the total RMP. To calculate this probability, we need the combined probability for *all* alleles at *all* loci. Simply multiply together your probabilities calculated in the previous 3 questions. Write your answer to the 3rd decimal place.

Answer:



Information

Part 2: Calculating Allele Frequencies and Probabilities

Do the calculations and answer the questions on the following slides.

You may find it helpful to record your answers to each question as they may be useful for answering later questions.

Question 8

Correct

Points out of 1.00

A sample of individuals from a given population are collected to estimate the allele frequencies for the population at large.

Data on 5 STR loci are provided:

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
1	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Based on the sample of 15 individuals above, what is the frequency of Allele 13 for CSF1PO? Typically, this frequency is calculated from a population. Here, the 15 individuals are the "population." Write your answer as a decimal.

Answer: 

Question 9

Correct

Points out of 1.00



Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
1	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

For STR CSF1PO, what is the probability of Allele 13 being present in a randomly selected individual, i.e. $P(13)$? Write your answer as a decimal.

Hint: Recall the relationship between frequency and probability.

Answer: 0.2



Question 10

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
1	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Based on the sample of 15 individuals above, what is the frequency of Allele 11 for CSF1PO? Write your answer to the 4th decimal place.

Answer:



Question 11

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
1	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Based on the results from the previous questions, which allele, Allele 11 or Allele 13, is the most useful in generating a strong random match probability?

Hint: Recall the relationship between frequency and probability.

Select one:

- ☒ a. Allele 11
- ☐ b. Allele 13



Question 12

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
1	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

For STR CSF1PO, what is the probability of both Alleles 11 **and** 13 being present in a randomly selected individual, also called the genotype frequency? Write your answer to the 3rd decimal place.

Hint: recall genotype frequency calculation for heterozygous genotypes = $2pq$

Answer:



Question 13

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
1	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Based on the sample of 15 individuals above, what is the probability that a randomly selected individual will have Alleles 3 and 8 at D3S1358 **and** Alleles 4 and 6 at D8S1179? Write your answer to the 5th decimal.

Answer: 

Information

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Assume that Individual 1 in the above table is the DNA evidence found at the crime scene. For the next 15 questions, work towards calculating the RMP for this individual's DNA results based on the "population" allele frequencies from the remaining reference samples in the table (Individuals 2-15). So, while in the previous questions, you based your calculations on individuals 1-15, it is now based on individuals 2 to 15.

You will be given hints along the way to help. **Be sure to make note of the correct answer for each question as later questions build on the answers of the previous questions.**

Question 14

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Calculate the probability of Allele 5 for CSF1PO.

P(5) =



Round your answer accurately to the 3rd decimal place.

Hint: Recall that the probability of a given allele is the same as calculating the frequency of that allele in the sample, which is individuals 2-15 in this section.

Question 15

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Calculate the probability of Allele 6 for CSF1PO using your available sample (Individuals 2-15).

P(6) =



Round your answer accurately to the 3rd decimal place.

Question 16

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

What is the genotype frequency of the DNA Evidence for CSF1PO?

Hint: Notice that the evidence have two different alleles in their genotype, a 5 and a 6, so you will need to use the genotype frequency calculation for heterozygous genotypes. Also, recall that in the previous two questions, you calculated the *allele* frequencies for alleles 5 and 6 separately, so you are ready to incorporate them into the heterozygous genotype frequency formula.

Round your answer accurately to the 3rd decimal place.

Answer: 0.015



Question 17

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Calculate the probability of Allele 3 for D3S1358 using your available sample (Individuals 2-15)

P(3)= ✓

Round your answer accurately to the 3rd decimal place.

Question 18

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

What is the genotype frequency of Individual 1 for D3S1358? This can also be thought of as P(3,3), which is a *homozygote* genotype, so be sure to use the correct equation from the lecture.

Round your answer accurately to the 3rd decimal place.

Answer:



Question 19

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Calculate the probability of Allele 10 for D5S818 using your available sample (Individuals 2-15)

P(10)= 

Round your answer accurately to the 3rd decimal place.

Question 20

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

Calculate the probability of Allele 15 for D5S818 using your available sample (Individuals 2-15).

P(15)=



Round your answer accurately to the 3rd decimal place.

Question 21

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

What is the genotype frequency of the DNA Evidence for D5S818? This can also be thought of as P(10, 15), which is a heterozygote genotype.

Round your answer accurately to the 3rd decimal place.

Answer:



Question 22

Correct

Points out of 1.00

Individual	CSF1PO	D3S1358	D5S818	D7S820	D8S1179
DNA Evidence	5,6	3,3	10,15	16,19	3,5
2	10,10	6,7	12,12	14,14	7,7
3	7,8	3,4	12,14	19,20	3,5
4	7,7	5,5	11,12	14,17	4,5
5	5,5	4,4	10,11	15,16	4,4
6	11,13	3,8	13,14	17,17	4,4
7	12,13	7,8	14,14	18,19	6,9
8	13,13	5,5	10,14	19,20	5,5
9	7,9	5,5	11,12	14,20	4,5
10	10,11	3,6	10,11	15,15	4,4
11	11,13	3,8	13,14	17,19	4,4
12	12,12	6,7	14,14	18,20	6,9
13	6,6	5,5	10,14	14,15	5,5
14	5,12	4,7	14,14	18,19	6,9
15	11,13	5,5	10,15	20,20	5,5

You have now calculated the DNA Evidence's genotype frequencies for the first three STRs in the table (CSF1PO, D3S1358, AND D5S818). What is the chance for a person from this population to have these three combined genotypes? In other words, calculate the Random Match Probability (RMP) for the DNA Evidence.

Hint: You've already calculated everything you need for this, which are the genotype frequencies for those three STRs. Now, apply the product rule as discussed in the lecture to find the RMP.

Round your answer accurately to the **7th** decimal place.

Answer:



Information

Part 3: Paternity Testing

Work through this [Paternity Testing](#) activity.

Then answer the following True or False questions.

Question **23**

Correct

Points out of 1.00

Results from a single locus can prove someone is NOT the father of a certain child.

Select one:

- ☒ a. True
- ☐ b. False

Question **24**

Correct

Points out of 1.00

Results from a single locus can prove someone IS the father of a certain child.

Select one:

- ☒ a. False
- ☐ b. True

Question **25**

Correct

Points out of 1.00

A common allele shared between a man and a child is less convincing evidence of paternity than a shared rare allele.

Select one:

- ☐ a. False
- ☒ b. True

