QUESTIONS

1. (10 points) Describe the role of DNA in protein synthesis.

DNA is a crucial molecule where biological information is stored and protein synthesis is regulated. DNA synthesizes mRNA through an enzyme called RNA polymerase, it is also known as transcrption. mRNA carries genetic information, while tRNA transports amino acids. These molecules come together in the ribosome and are connected by peptide bonds. As a result of this process, functional protein structures are formed, enabling all living organisms to sustain and reproduce themselves.

2. (10 points) Find the template DNA sequence and the coding strand for the given t-RNA sequence.

t-RNA	A	U	G	C	U	U	A	G	C	U
Template DNA strand	A	T	G	C	T	T	A	G	C	T
Coding DNA strand	T	A	C	G	A	A	T	C	G	A

3. (10 points) Explain codon structure and describe the relationship between codon and aminoacids.

Three-bases RNA structure is called as codons. Codons map and encode aminoacides, the order of aminoacides determined by mRNA.

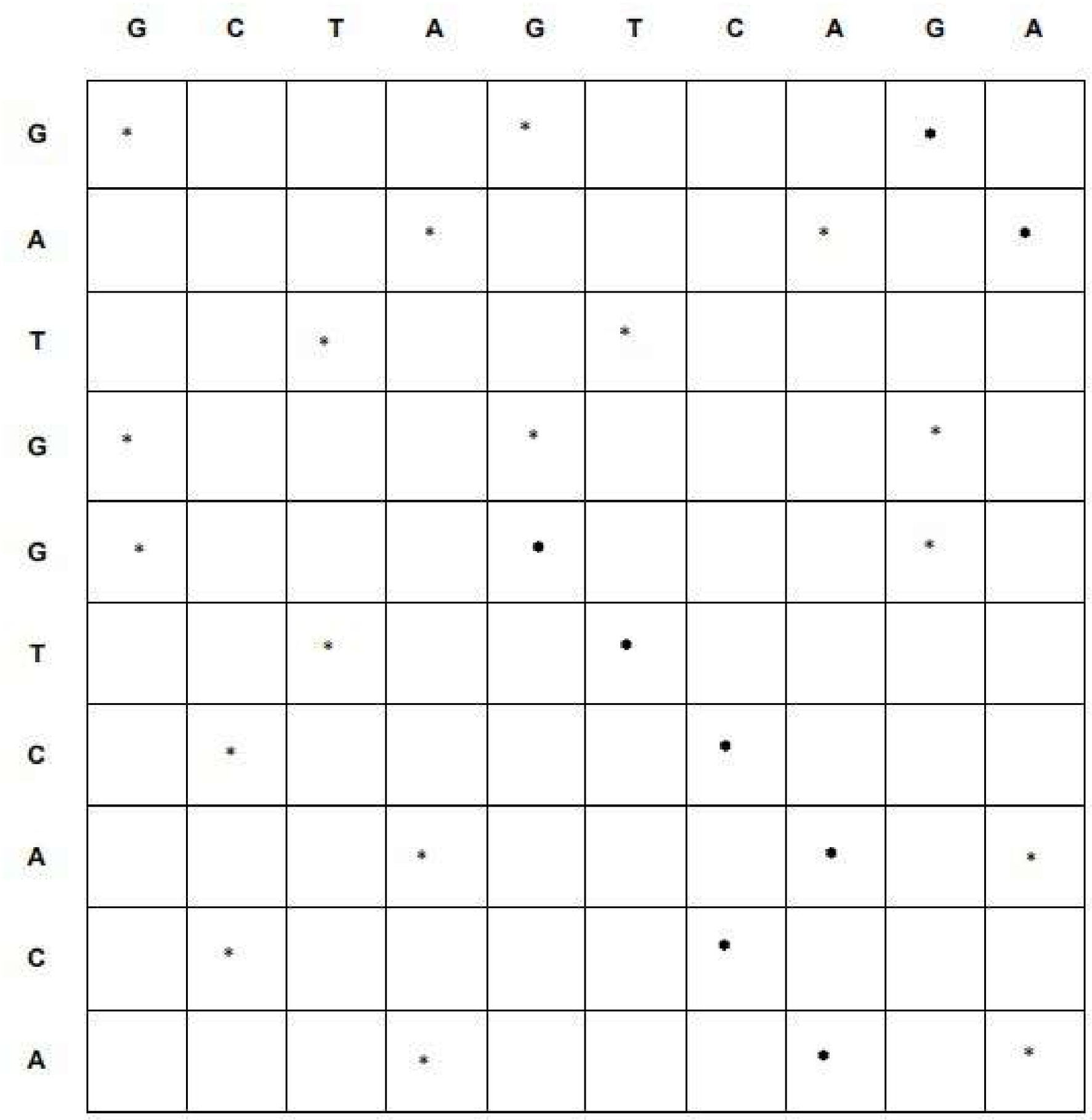
4. (10 points) Explain the 4 levels proteins are examined.

1	The primary structure is the protein sequence, the types and order of the amino acids in the protein chain.
2	The secondary structure is the first level of protein folding, in which parts of the chain fold to form generic structures that are found in all proteins.
3	The tertiary structure is formed by the further folding and packing together of these elements to give the final three-dimensional conformation unique to the protein.
4	Many functional proteins are formed of more than one protein chain, in which case the individual chains are called protein subunits. The subunit composition and arrangement in such multisubunit proteins is called the quaternary conformation.

5. (10 points) Describe, compare and contrast homology and similarity concepts.

Proteins that have a common ancestor are referred to as being homologous. Homologous proteins usually have a similar three-dimensional structure with related active sites and binding domains. On the other hand, similarity is about the number of shared sequences and is correlated with some functionalities. Homology refers to a common ancestor, while similarity refers to shared sequences and functionalities.

6. (10 points) Create the dot-plot for the given sequences.



7. (10 points) Describe the method used for removing the background noise in dot-plots by elaborating the parameters used in the method.

To overcome backgroud noise it is necessary to apply a filter

The most-commonly used filtering method uses a sliding window and requires that the comparison achieves some minimum identity score summed over that window before being considered.

8. (10 points) How many alternative alignments can be found for two DNA sequences of length 10 and 8 by allowing insertion of gaps?

$$f(10,8) = \sum_{k=0}^{\min\{10,8\}} 2^k \binom{8}{k}\binom{10}{k} \qquad \binom{10}{k} = \frac{10!}{k!(11-k)!} \qquad \binom{8}{k} = \frac{8!}{k!(8-k)!}$$