

dna fingerprinting in forensics answer key

****Understanding DNA Fingerprinting in Forensics Answer Key****

dna fingerprinting in forensics answer key is a fascinating topic that bridges the gap between biology and criminal justice. This technique has revolutionized the way investigators solve crimes by providing a reliable method to identify individuals based on their unique genetic makeup. If you're diving into forensic science or preparing for exams related to DNA fingerprinting, having a thorough understanding of the concepts and their practical applications is crucial. Let's explore how DNA fingerprinting works, its significance in forensic investigations, and the key points that often appear in answer keys or study guides.

What is DNA Fingerprinting in Forensics?

DNA fingerprinting, also known as DNA profiling, is a laboratory technique used to establish a genetic fingerprint unique to every individual (except identical twins). In forensic science, this method helps link suspects to crime scenes, identify victims, and exonerate the innocent by analyzing DNA samples found on evidence such as blood, hair, saliva, or skin cells.

The process involves comparing specific regions of DNA called variable number tandem repeats (VNTRs) or short tandem repeats (STRs). These regions vary greatly among individuals, making them ideal markers for identification.

How DNA Fingerprinting Works

The DNA fingerprinting process typically follows these steps:

1. ****DNA Extraction:**** Collecting DNA from biological samples such as blood, hair follicles, or skin cells.
2. ****DNA Quantification:**** Measuring the amount of DNA to ensure sufficient material for analysis.
3. ****PCR Amplification:**** Using Polymerase Chain Reaction (PCR) to amplify specific STR regions, making millions of copies.
4. ****Gel Electrophoresis:**** Separating DNA fragments based on size through a gel matrix to visualize the unique pattern.
5. ****Comparison:**** Matching the DNA pattern from the crime scene sample with that of suspects or reference samples.

This method produces a distinct band pattern—or “fingerprint”—that forensic scientists use to determine identity.

Why DNA Fingerprinting is Crucial in Forensic Investigations

The importance of DNA fingerprinting in forensics cannot be overstated. It has become the gold standard for evidence analysis due to its accuracy and reliability. Here are some reasons why it plays a pivotal role in criminal justice:

- **High Precision:** Even trace amounts of DNA can be analyzed to produce a near-definitive identification.
- **Exoneration of Innocent People:** DNA evidence has overturned wrongful convictions by proving a suspect's innocence.
- **Crime Scene Linkage:** It can connect multiple crime scenes by identifying the same DNA profile.
- **Victim Identification:** Useful in cases where victims are unrecognizable or missing.

The answer key for DNA fingerprinting in forensic contexts often highlights these points to emphasize the technique's value.

Types of DNA Markers Used in Forensics

Understanding the markers used in DNA fingerprinting is essential for grasping how forensic scientists interpret results:

- **VNTRs (Variable Number Tandem Repeats):** Longer repeating sequences used in earlier DNA fingerprinting methods.
- **STRs (Short Tandem Repeats):** Short sequences repeated multiple times, currently preferred due to their abundance and variability.
- **Mitochondrial DNA:** Used when nuclear DNA is degraded or insufficient, particularly in old or damaged samples.
- **Y-Chromosome STRs:** Helpful in cases involving male lineage or sexual assault investigations.

Each marker type offers unique advantages depending on the forensic scenario.

Common Questions and Answer Keys Related to DNA Fingerprinting in Forensics

When studying DNA fingerprinting, especially for exams or practical applications, certain questions consistently appear. Knowing these can help clarify concepts and improve comprehension.

1. What Makes DNA Fingerprinting Unique for Individuals?

Answer: The unique pattern of STRs scattered throughout the genome varies significantly among individuals, except identical twins, making each DNA fingerprint distinctive.

2. How Does PCR Enhance DNA Fingerprinting?

Answer: PCR amplifies small quantities of DNA, allowing forensic scientists to analyze minute or degraded samples that would otherwise be insufficient.

3. Why is DNA Fingerprinting More Reliable than Other Identification Methods?

Answer: Because the probability of two unrelated individuals having the same DNA profile is astronomically low, making it a highly accurate identification tool.

4. What Are the Limitations of DNA Fingerprinting?

Answer: Contamination of samples, degraded DNA, and human error during analysis can affect results. Also, identical twins have indistinguishable DNA profiles using standard methods.

Tips for Interpreting DNA Fingerprinting Results in Forensics

Understanding the science is one thing, but correctly interpreting DNA fingerprinting results is equally vital. Here are some tips:

- ****Look for Band Matches:**** In gel electrophoresis, matching bands between the crime scene sample and suspect's sample indicate a potential match.
- ****Consider Probability:**** Forensic labs often calculate the probability that the DNA profile matches someone else in the population, which must be extremely low to confirm identity.
- ****Check for Contamination:**** Always verify that the sample was not contaminated during collection or processing.
- ****Use Controls:**** Positive and negative controls in experiments ensure the reliability of results.

These insights often appear in answer keys to guide students and practitioners in evaluating DNA evidence effectively.

Real-World Applications of DNA Fingerprinting in Forensics

Beyond textbooks and classrooms, DNA fingerprinting has played a critical role in solving countless real-life cases. Some notable examples include:

- **Cold Case Resolutions:** DNA evidence has solved decades-old crimes by re-examining stored samples.
- **Disaster Victim Identification:** Mass disasters use DNA profiling to identify victims when visual recognition is impossible.
- **Paternity and Family Disputes:** Although not strictly forensic, DNA fingerprinting aids legal cases involving family relationships.
- **Wildlife Crime Investigations:** Identifying poached animals or illegal trade using genetic markers.

Each application demonstrates the versatility and power of DNA fingerprinting in different contexts.

Ethical Considerations in Forensic DNA Fingerprinting

While DNA fingerprinting is a powerful tool, it raises important ethical questions:

- **Privacy Concerns:** The storage and use of DNA profiles must respect individuals' privacy rights.
- **Potential for Misuse:** DNA databases could be misused for surveillance or discrimination.
- **Informed Consent:** Collecting DNA samples should involve clear consent procedures.

Addressing these concerns ensures that forensic science advances responsibly and ethically.

DNA fingerprinting in forensics answer key materials often touch on these ethical aspects to encourage thoughtful discussion alongside technical knowledge.

Exploring the intricacies of DNA fingerprinting in forensic science reveals not only its impressive technical foundation but also its profound impact on justice and society. Whether you're a student, professional, or curious reader, understanding the answer key points behind this technology equips you with a clearer perspective on how modern forensics works to uphold truth and fairness.

Frequently Asked Questions

What is DNA fingerprinting in forensics?

DNA fingerprinting in forensics is a technique used to identify individuals based on their unique DNA patterns, helping to link suspects to crime scenes or exonerate the innocent.

How is DNA fingerprinting used to solve crimes?

DNA fingerprinting analyzes specific regions of a person's DNA to create a unique profile, which can be compared to DNA found at crime scenes to identify or exclude suspects.

What types of biological samples can be used for DNA fingerprinting in forensics?

Biological samples such as blood, hair follicles, skin cells, saliva, semen, and other bodily fluids can be used for DNA fingerprinting in forensic investigations.

What is the role of STRs (Short Tandem Repeats) in forensic DNA fingerprinting?

STRs are repeating sequences in DNA that vary greatly among individuals; analyzing these regions provides a highly specific DNA profile used in forensic identification.

How accurate is DNA fingerprinting in forensic cases?

DNA fingerprinting is highly accurate, with a very low probability of two individuals having the same DNA profile, making it a reliable tool in forensic investigations.

What is the difference between DNA fingerprinting and DNA profiling?

DNA fingerprinting originally referred to the early method of identifying individuals using DNA patterns, while DNA profiling is a more advanced and precise technique analyzing specific genetic markers.

Can DNA fingerprinting be used to identify missing persons?

Yes, DNA fingerprinting can be used to identify missing persons by comparing

their DNA profiles with those of relatives or with unidentified remains.

What are the limitations of DNA fingerprinting in forensics?

Limitations include degraded or insufficient DNA samples, contamination, and the need for a reference sample for comparison; also, identical twins have identical DNA profiles, making differentiation impossible.

How has DNA fingerprinting impacted the criminal justice system?

DNA fingerprinting has revolutionized the criminal justice system by providing strong, scientific evidence for convicting the guilty and exonerating the innocent, improving the accuracy of trials and verdicts.

Additional Resources

****DNA Fingerprinting in Forensics Answer Key: Unlocking the Science Behind Criminal Investigations****

dna fingerprinting in forensics answer key serves as a critical guide for understanding the intricate process and applications of DNA analysis in criminal investigations. As forensic science continues to evolve, DNA fingerprinting remains a cornerstone technique, providing irrefutable evidence in courts worldwide. This article explores the fundamentals behind DNA fingerprinting in forensics, elucidates its scientific underpinnings, and addresses the answer key to common queries and challenges encountered in forensic casework.

Understanding DNA Fingerprinting in Forensics

DNA fingerprinting, also known as DNA profiling, is a molecular biology method used to identify individuals based on unique patterns in their genetic material. Since its introduction in the 1980s by Sir Alec Jeffreys, DNA fingerprinting has revolutionized forensic investigations by enabling precise matching of biological samples to suspects or victims.

The “dna fingerprinting in forensics answer key” concept helps demystify how forensic experts extract, analyze, and interpret DNA to establish links between crime scenes and individuals. The process hinges on the fact that, except for identical twins, every person’s DNA sequence contains distinct variations in specific regions which can be targeted for profiling.

Key Steps in DNA Fingerprinting for Forensics

The forensic DNA fingerprinting process generally involves the following steps:

1. **Sample Collection:** Biological evidence such as blood, saliva, hair follicles, or skin cells are collected from crime scenes.
2. **DNA Extraction:** DNA is carefully isolated from the collected samples, ensuring purity and quality for further analysis.
3. **Quantification:** The amount of DNA is measured to determine if it is sufficient for profiling.
4. **Amplification by PCR:** Polymerase Chain Reaction (PCR) is employed to amplify specific DNA regions, especially Short Tandem Repeats (STRs), which are highly polymorphic.
5. **Separation and Detection:** Amplified DNA fragments are separated using gel or capillary electrophoresis to generate a distinctive banding pattern.
6. **Profile Interpretation:** The resulting DNA profile is compared with known samples to ascertain matches or exclusions.

This structured approach provides a scientific framework that forensic analysts rely on to generate reliable and reproducible DNA profiles.

The Science Behind DNA Profiling: An Analytical Perspective

DNA fingerprinting in forensics answer key requires an understanding of genetic markers used in profiling. STRs are the most commonly analyzed polymorphic regions due to their high variability among individuals and short length, making them ideal for PCR amplification even from degraded samples.

Short Tandem Repeats (STRs) and Their Forensic Importance

STRs consist of repeating sequences of 2-6 base pairs scattered throughout the human genome. Their variability in repeat number between individuals forms the basis for differentiation. Typically, forensic laboratories analyze

a set of standard STR loci, such as those recommended by CODIS (Combined DNA Index System), which includes 20 core loci in the United States.

The probability of two unrelated individuals sharing the same STR profile across all loci is astronomically low—often less than one in a billion—thus providing compelling evidence in criminal cases.

Comparative Advantages of STR Analysis

Compared to older methods like Restriction Fragment Length Polymorphism (RFLP), STR analysis offers several benefits:

- **Speed:** PCR-based STR profiling can be completed within hours.
- **Sample Requirements:** Requires smaller and potentially degraded DNA samples.
- **Automation:** Modern capillary electrophoresis instruments enable high throughput processing.
- **Standardization:** Global databases facilitate cross-jurisdictional searches.

These features enhance the efficiency and accuracy of forensic investigations.

Applications and Challenges in Forensic Contexts

The application of DNA fingerprinting in forensic science extends beyond identifying suspects. It includes victim identification, paternity testing, and exoneration of wrongfully convicted individuals. However, the dna fingerprinting in forensics answer key also highlights limitations and challenges that must be addressed.

Casework Applications

DNA profiles have been instrumental in solving cold cases where traditional investigative methods failed. For example, familial DNA searching enables detection of close relatives of suspects when direct matches are unavailable. Additionally, low copy number (LCN) DNA profiling allows analysis of minute biological traces.

Limitations and Potential Pitfalls

Despite its power, DNA fingerprinting is not infallible. Some challenges include:

- **Contamination:** DNA samples can be easily contaminated during collection or analysis, leading to erroneous results.
- **Mixed Samples:** Crime scenes often contain DNA from multiple individuals, complicating interpretation.
- **Degraded DNA:** Environmental factors may degrade DNA, reducing the quality of profiles.
- **Statistical Interpretation:** Misunderstanding the statistical significance of matches can mislead juries.

Awareness of these issues is essential for forensic practitioners to maintain the integrity of DNA evidence.

Legal and Ethical Considerations in DNA Fingerprinting

The DNA fingerprinting in forensics answer key also encompasses the legal frameworks governing the collection, storage, and use of DNA data. Privacy concerns and potential misuse of genetic information are ongoing debates within the forensic community and society.

Many countries have established strict protocols regarding DNA databanks, ensuring that profiles are used solely for criminal justice purposes while safeguarding individual rights. Transparency in methods and reporting is critical for upholding public trust in forensic science.

Future Directions and Technological Innovations

Emerging technologies such as next-generation sequencing (NGS) and rapid DNA testing promise to further enhance forensic capabilities. These developments may allow simultaneous analysis of a broader range of genetic markers and quicker turnaround times, expanding the scope of DNA fingerprinting in forensics.

Moreover, integrating artificial intelligence for pattern recognition and data interpretation is poised to reduce human error and improve case

outcomes.

The continuous evolution in forensic DNA methodologies underscores the importance of staying updated with the dna fingerprinting in forensics answer key, ensuring that best practices are universally adopted.

The utilization of DNA fingerprinting in forensic investigations remains an indispensable asset in modern criminal justice systems. By unraveling the complexities of genetic evidence, forensic experts can provide clear, scientifically grounded answers that influence legal decisions. Understanding the detailed answer key to DNA fingerprinting processes and principles empowers practitioners, legal professionals, and the public alike to appreciate the profound impact of this technology on societal safety and justice.

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dna fingerprinting in forensics answer key: DNA Fingerprinting: Advancements and Future Endeavors Hirak Ranjan Dash, Pankaj Shrivastava, Braja Kishore Mohapatra, Surajit Das, 2018-11-01 This book describes the basics and various applications of DNA fingerprinting, including in actual case studies. The book is divided in four modules; Module 1: Basics of DNA Fingerprinting, Module 2: Applications of DNA Fingerprinting, Module 3: DNA Fingerprinting: Case Studies, and Module 4: Future of DNA Fingerprinting. Each module consists of 4 to 5 chapters, written by reputed researchers, academics and forensic scientists from around the globe. The respective chapters cover e.g. related fields, the tools and techniques used, various genotyping kits, real-world case studies, ancient DNA and wild life forensics, molecular diagnosis of human diseases, legal aspects, microbial forensics and the economics of the DNA fingerprinting technique. The book offers a practical guide for professionals, graduate and post-graduate students in the fields of Forensic Science, Medicine, Genetics, Anthropology, Microbiology, and Zoology. It also serves as a useful reference resource, summarizing major technological advances in the field of DNA fingerprinting, the problems faced in this field of science and possible new solutions to these problems. Presently, DNA fingerprinting is utilized in solving the majority of criminal cases; as such, the book is also helpful for investigating agencies, as it includes representative case studies.

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identification, pH and pH indicators, mammal skulls, and tracks and trace fossils. 3. An investigation simulation based on a real wildlife crime: the illegal shooting and dismemberment of a bear. Students work in teams to review crime scene reports, conduct interviews of suspects and witnesses, analyze evidence, and bring charges before a prosecuting attorney. 4. Teacher strategies for evaluating individual students and student teams. Using Forensics: Wildlife Crime Scene! is an ideal complement to middle and high school courses in biology, environmental science, general science, and criminology. It provides a high-interest, real-life format for learning a variety of scientific concepts and skills that correlate with the Standards. It also gives students reason to genuinely care about preserving the wildlife and ecosystems they're studying.

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Lisa A. Seidman, Cynthia J. Moore, Jeanette Mowery, 2021-12-28 Basic Laboratory Methods for Biotechnology, Third Edition is a versatile textbook that provides students with a solid foundation to pursue employment in the biotech industry and can later serve as a practical reference to ensure success at each stage in their career. The authors focus on basic principles and methods while skillfully including recent innovations and industry trends throughout. Fundamental laboratory skills are emphasized, and boxed content provides step by step laboratory method instructions for ease of reference at any point in the students' progress. Worked through examples and practice problems and solutions assist student comprehension. Coverage includes safety practices and instructions on using common laboratory instruments. Key Features: Provides a valuable reference for laboratory professionals at all stages of their careers. Focuses on basic principles and methods to provide students with the knowledge needed to begin a career in the Biotechnology industry. Describes fundamental laboratory skills. Includes laboratory scenario-based questions that require students to write or discuss their answers to ensure they have mastered the chapter content. Updates reflect recent innovations and regulatory requirements to ensure students stay up to date. Tables, a detailed glossary, practice problems and solutions, case studies and anecdotes provide students with the tools needed to master the content.

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Malcolm Burns, Lucy Foster, Michael Walker, 2019-10-14 The food supply chain needs to reassure consumers and businesses about the safety and standards of food. Global estimates of the cost of food fraud to economies run into billions of dollars hence a huge surge in interest in food authenticity and means of detecting and preventing food fraud and food crime. Approaches targeting DNA markers have assumed a pre-eminence. This book is the most comprehensive and timely collection of material from those working at the forefront of DNA techniques applied to food authenticity. Addressing the new field of analytical molecular biology as it combines the quality assurance rigour of analytical chemistry with DNA techniques, it introduces the science behind DNA as a target analyte, its extraction, amplification, detection and quantitation as applied to the detection of food fraud and food crime. Making the link with traditional forensic DNA profiling and describing emerging and cutting-edge techniques such as next generation sequencing, this book presents real-world case studies from a wide perspective including from analytical service providers, industry, enforcement agencies and academics. It will appeal to food testing laboratories worldwide, who are just starting to use these techniques and students of molecular biology, food science and food integrity. Food policy professionals and regulatory organisations who will be using these techniques to back up legislation and regulation will find the text invaluable. Those in the food industry in regulatory and technical roles will want to have this book on their desks.

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William Goodwin, Adrian Linacre, Sibte Hadi, 2011-06-28 This is a completely revised edition of a comprehensive and popular introduction to the fast moving area of Forensic Genetics. The text begins with key concepts needed to fully appreciate the subject and moves on to examine the latest developments in the field. Now illustrated in full colour throughout, this accessible textbook includes numerous references to relevant casework. With information on the full process of DNA evidence from collection at the scene of a crime to presentation in a legal context this book provides a

complete overview of the field. Key Features: Greater in-depth coverage of kinship problems now covered in two separate chapters: one dealing with relationships between living individuals and the other covering identification of human remains. New chapter on non-human forensic genetics, including identification of bacteria and viruses, animals and plants. Self assessment questions to aid student understanding throughout the text. Now with full colour illustrations throughout New companion website Accessible introduction to forensic genetics, from the collection of evidence to the presentation of evidence in a legal context. Included in the Forensic Science Society 'Essentials in Forensic Science' book series. This edition is to be included in the Forensic Science Society 'Essentials of Forensic Science' book series aimed at advanced level undergraduates and new practitioners to the field.

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CLONINGGENOME ORGANIZATIONTOOLS FOR GENE CLONINGGENE IDENTIFICATION AND
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Releasing contaminants into the environment—whether deliberate or unintentional—can be thought of as a crime against the environment. The role of environmental forensics is to identify and prevent environmental pollution, or crimes. Environmental Forensics Fundamentals: A Practical Guide examines this growing field, and provides environmental professionals looking to specialize in environmental forensics with the materials they need to effectively investigate and solve crimes against the environment. Pointing the Finger at Environmental Crime Environmental forensics uses fingerprinting techniques in order to assess and analyze contamination sites. Fingerprinting can reveal the source of contamination, as well as how, where, and when the contamination was released. This handy guidebook outlines the proven techniques, applications, and resources needed to efficiently investigate environmental crimes and become successful in this emerging field. Learn the Basics from a Single Source Divided into three main parts, the first part of the book examines the role of evidence in forensic investigations and court proceedings. It highlights general forensic concepts and offers guidelines for obtaining defensible evidence. The second part details environmental forensic investigative techniques. It includes a step-by-step guide that enables the reader to apply the techniques in practice. The final section covers strategy building. It presents real case studies, as well as key principles and concepts for strategy building, and addresses the most common challenges faced in environmental forensics. Environmental Forensics Fundamentals: A Practical Guide provides information on cutting-edge scientific techniques that investigate the

source and age of environmental pollution and solve environmental crimes. It examines the principles behind each main forensic technique. It also offers guidance on what to look for in order to successfully apply the techniques and interpret results. In addition, the author provides relevant sources where more information can be found.

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scientists in each area, every article is peer reviewed to establish clarity, accuracy, and comprehensiveness. As reflected in the specialties of its Editorial Board, the contents covers the core theories, methods and techniques employed by forensic scientists – and applications of these that are used in forensic analysis. This 4-volume set represents a 30% growth in articles from the first edition, with a particular increase in coverage of DNA and digital forensics. Includes an international collection of contributors. The second edition features a new 21-member editorial board, half of which are internationally based. Includes over 300 articles, approximately 10pp on average. Each article features a) suggested readings which point readers to additional sources for more information, b) a list of related Web sites, c) a 5-10 word glossary and definition paragraph, and d) cross-references to related articles in the encyclopedia. Available online via SciVerse ScienceDirect. Please visit www.info.sciencedirect.com for more information. This new edition continues the reputation of the first edition, which was awarded an Honorable Mention in the prestigious Dartmouth Medal competition for 2001. This award honors the creation of reference works of outstanding quality and significance, and is sponsored by the RUSA Committee of the American Library Association.

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dna fingerprinting in forensics answer key: Cyber Crime and Forensic Computing Gulshan Shrivastava, Deepak Gupta, Kavita Sharma, 2021-09-07 This book presents a comprehensive study of different tools and techniques available to perform network forensics. Also, various aspects of network forensics are reviewed as well as related technologies and their limitations. This helps security practitioners and researchers in better understanding of the problem, current solution space, and future research scope to detect and investigate various network intrusions against such attacks efficiently. Forensic computing is rapidly gaining importance since the amount of crime involving digital systems is steadily increasing. Furthermore, the area is still underdeveloped and poses many technical and legal challenges. The rapid development of the Internet over the past decade appeared to have facilitated an increase in the incidents of online attacks. There are many reasons which are motivating the attackers to be fearless in carrying out the attacks. For example, the speed with which an attack can be carried out, the anonymity provided by the medium, nature of medium where digital information is stolen without actually removing it, increased availability of potential victims and the global impact of the attacks are some of the aspects. Forensic analysis is performed at two different levels: Computer Forensics and Network Forensics. Computer forensics deals with the collection and analysis of data from computer systems, networks, communication streams and storage media in a manner admissible in a court of law. Network forensics deals with the capture, recording or analysis of network events in order to discover evidential information about the source of security attacks in a court of law. Network forensics is not another term for

network security. It is an extended phase of network security as the data for forensic analysis are collected from security products like firewalls and intrusion detection systems. The results of this data analysis are utilized for investigating the attacks. Network forensics generally refers to the collection and analysis of network data such as network traffic, firewall logs, IDS logs, etc. Technically, it is a member of the already-existing and expanding the field of digital forensics. Analogously, network forensics is defined as The use of scientifically proved techniques to collect, fuses, identifies, examine, correlate, analyze, and document digital evidence from multiple, actively processing and transmitting digital sources for the purpose of uncovering facts related to the planned intent, or measured success of unauthorized activities meant to disrupt, corrupt, and or compromise system components as well as providing information to assist in response to or recovery from these activities. Network forensics plays a significant role in the security of today's organizations. On the one hand, it helps to learn the details of external attacks ensuring similar future attacks are thwarted. Additionally, network forensics is essential for investigating insiders' abuses that constitute the second costliest type of attack within organizations. Finally, law enforcement requires network forensics for crimes in which a computer or digital system is either being the target of a crime or being used as a tool in carrying a crime. Network security protects the system against attack while network forensics focuses on recording evidence of the attack. Network security products are generalized and look for possible harmful behaviors. This monitoring is a continuous process and is performed all through the day. However, network forensics involves post mortem investigation of the attack and is initiated after crime notification. There are many tools which assist in capturing data transferred over the networks so that an attack or the malicious intent of the intrusions may be investigated. Similarly, various network forensic frameworks are proposed in the literature.

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