

the people are independent, each birthday is equally likely, and

User

Can you explain the birthday problem?

AI

Sure! Here is an explanation of the Birthday Problem based on the given information:

The Birthday Problem is a puzzle that asks for the minimum number of people needed in a room to ensure that at least two of them have the same day of the year as their birthday.

In Example 13, the problem asks for the minimum number of people needed so that the probability of at least two people having the same birthday is greater than $1/2$.

Assumptions made for this problem include: the birthdays of the people are independent, each birthday is equally likely, and

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By: Wei, Helen, Eddie, Estelle, Amber, Justice

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Discrete Mathematics and Its Applications

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Euler and Hamilton Paths

Introduction - Can we traverse all edges of a graph starting and edge exactly once? (Euler circuit) - Can we traverse all edges of vertex, visiting each vertex exactly once? (Hamilton circuit) - Euler by examining vertex degrees, while the Hamilton circuit question **Paths and Circuits** - Königsberg bridge problem: Seven bridges - Townspeople wondered if it was possible to start at some location crossing any twice, and return to the starting point. - Euler solved model of the town. **Königsberg Bridge Problem Solution** - Euler Follow an untraversed edge to an adjacent vertex. - Repeat step - If you can return to the starting vertex, the graph has an Euler circuit starting vertex, the graph does not have an Euler circuit. **Eulerian** circuit is called an Eulerian graph. - An Eulerian graph must satisfy even degree. - The graph is connected. **Hamilton Paths and Circuits** each vertex of a graph exactly once is called a Hamiltonian path. Each vertex of a graph exactly once is called a Hamiltonian circuit. The circuit in a graph is a difficult problem to solve for most graphs. Applications: Scheduling problems - Routing problems - Hamiltonian circuits: - VLSI circuit design

what are the necessary and sufficient conditions for a graph to have an Euler circuit?

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Necessary and Sufficient Conditions for Euler Circuits and Paths - A graph has an Euler circuit, then every vertex must have even degree. - A graph has an Euler path if and only if every vertex has even degree.

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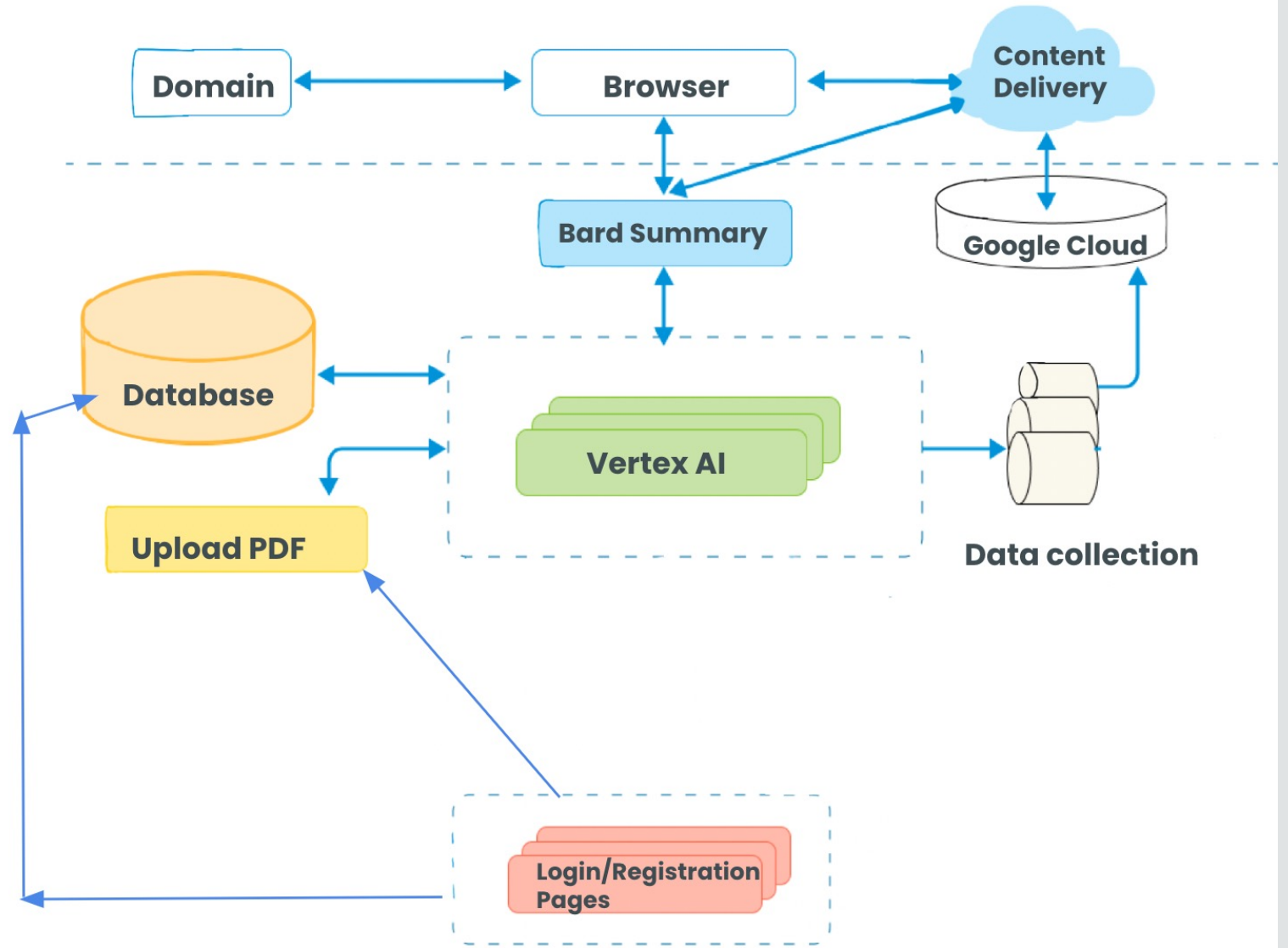
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Website architecture



Database Diagram



Challenges



Displaying PDF documents



Testing database



Switching from OpenAI to Vertex AI

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school are sophomores majoring in mathematics or computer science and have greater than a 3.0 average? Which employees of a company have worked for the company less than 5 years and make more than \$50,000?

n -ary Relations

We begin with the basic definition on which the theory of relational databases rests.

DEFINITION 1 Let A_1, A_2, \dots, A_n be sets. An n -ary relation on these sets is a subset of $A_1 \times A_2 \times \dots \times A_n$. The sets A_1, A_2, \dots, A_n are called the *domains* of the relation, and n is called its *degree*.

EXAMPLE 1 Let R be the relation on $\mathbb{N} \times \mathbb{N} \times \mathbb{N}$ consisting of triples (a, b, c) , where a, b , and c are integers with $a < b < c$. Then $(1, 2, 3) \in R$, but $(2, 4, 3) \notin R$. The degree of this relation is 3. Its domains are all equal to the set of natural numbers.

EXAMPLE 2 Let R be the relation on $\mathbb{Z} \times \mathbb{Z} \times \mathbb{Z}$ consisting of all triples of integers (a, b, c) in which a, b , and c form an arithmetic progression. That is, $(a, b, c) \in R$ if and only if there is an integer k such that $b = a + k$ and $c = a + 2k$, or equivalently, such that $b - a = k$ and $c - b = k$. Note that $(1, 3, 5) \in R$ because $3 = 1 + 2$ and $5 = 1 + 2 \cdot 2$, but $(2, 5, 9) \notin R$ because $5 - 2 = 3$ while $9 - 5 = 4$. This relation has degree 3 and its domains are all equal to the set of integers.

EXAMPLE 3 Let R be the relation on $\mathbb{Z} \times \mathbb{Z} \times \mathbb{Z}^+$ consisting of triples (a, b, m) , where a, b , and m are integers with $m \geq 1$ and $a \equiv b \pmod{m}$. Then $(8, 2, 3), (-1, 9, 5)$, and $(14, 0, 7)$ all belong to R , but $(7, 2, 3), (-2, -8, 5)$, and $(11, 0, 6)$ do not belong to R because $8 \not\equiv 2 \pmod{3}$, $-1 \not\equiv 9 \pmod{5}$, and $14 \not\equiv 0 \pmod{7}$, but $7 \not\equiv 2 \pmod{3}$, $-2 \not\equiv -8 \pmod{5}$, and $11 \not\equiv 0 \pmod{6}$. This relation has degree 3 and its first two domains are the set of all integers and its third domain is the set of positive integers.

EXAMPLE 4 Let R be the relation consisting of 5-tuples (A, N, S, D, T) representing airplane flights, where A is the airline, N is the flight number, S is the starting point, D is the destination, and T is the departure time. For instance, if Nadir Express Airlines has flight 963 from Newark to Bangor at 15:00, then $(\text{Nadir}, 963, \text{Newark}, \text{Bangor}, 15:00)$ belongs to R . The degree of this relation is 5, and its domains are the set of all airlines, the set of flight numbers, the set of cities, the set of cities (again), and the set of times.

Databases and Relations

The time required to manipulate information in a database depends on how this information is stored. The operations of adding and deleting records, updating records, searching for records, and combining records from overlapping databases are performed millions of times each day in a large database. Because of the importance of these operations, various methods for representing databases have been developed. We will discuss one of these methods, called the **relational data model**, based on the concept of a relation.

A database consists of **records**, which are n -tuples, made up of **fields**. The fields are the entries of the n -tuples. For instance, a database of student records may be made up of fields containing the name, student number, major, and grade point average of the student. The relational data model represents a database of records as an n -ary relation. Thus, student records



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## Summary of Relations

A relation is a subset of the Cartesian product of a set of domains. The degree of a relation is the number of domains in the Cartesian product. The domains of a relation are the sets from which the elements of the relation are drawn.

## Examples of Relations

- The relation  $R$  on  $\mathbb{N} \times \mathbb{N} \times \mathbb{N}$  consisting of triples  $(a, b, c)$  where  $a, b$ , and  $c$  are integers with  $a < b < c$ .
- The relation  $R$  on  $\mathbb{Z} \times \mathbb{Z} \times \mathbb{Z}$  consisting of all triples of integers  $(a, b, c)$  in which  $a, b$ , and  $c$  form an arithmetic progression.
- The relation  $R$  on  $\mathbb{Z} \times \mathbb{Z} \times \mathbb{Z}^+$  consisting of triples  $(a, b, m)$  where  $a, b$ , and  $m$  are integers with  $m \geq 1$  and  $a \equiv b \pmod{m}$ .
- The relation  $R$  consisting of 5-tuples  $(A, N, S, D, T)$  representing airplane flights, where  $A$  is the airline,  $N$  is the flight number,  $S$  is the starting point,  $D$  is the destination, and  $T$  is the departure time.

## Databases and Relations

A database consists of records, which are  $n$ -tuples, made up of fields. The fields are the entries of the  $n$ -tuples. A database of student records may be made up of fields containing the name, student number, major, and grade point average of the student. The relational data model represents a database of records as an  $n$ -ary relation.

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