Implementation of DBMS
Exercise Sheet 1b
Kln., WS 2023 / 2024

1) Probability and Statistics

We have a uniformly distributed random variable **Y** that can take integer values in the range **[50, 150]**. What is the mean of **Y**?

2) Storage and Containers

a) We have **boxes** that can hold up to **8 books**. We have **90 books** and want to store all of them in the boxes.
What is the minimum number of boxes that we need?

b) We have **34 jars**. Each jar contains **3 kg of flour**. We want to transfer all the flour into **large containers** that can hold up to **10 kg** each.
What is the minimum number of large containers needed?

3) Distance Measurement

A **hiking trail** starts from kilometre **3** and ends at kilometre **25**.
How many kilometres have you hiked in total?

4) Search Operations in a Database

You have a **database** with **500 records**. You want to find entries related to a specific keyword. The keyword might appear in multiple records.

a) You know that exactly **one record** contains the keyword. How many records do you need to inspect to find all relevant information? Consider the **minimum, maximum, and mean number of searches**.

b) There could be multiple records that contain the keyword, but you do not know how many. How many records do you need to inspect to ensure you retrieve all relevant information? Consider the **minimum, maximum, and mean number of searches**.

c) Assume that the database has an **index table** that lists the records containing the keyword. The index tells you that the keyword appears in **records 45, 132, and 287**.
Using the index, how many records do you have to inspect?

1) Probability and Statistics

We have a uniformly distributed random variable **Z** that can take integer values in the range **[10, 200]**. What is the mean of **Z**?

2) Storage and Packing Problems

a) We have **bags** that can carry up to **10 apples**. We have **95 apples** and want to pack all of them into bags.
What is the minimum number of bags needed?

b) We have **40 bottles**, each containing **1.5 liters of juice**. We want to pour all the juice into **large dispensers**, where each dispenser can hold up to **6 liters**.
What is the minimum number of dispensers required?

3) Distance Calculation

A **railway route** starts at kilometre **7** and ends at kilometre **45**.
How many kilometres is the train journey?

4) Searching in a Digital Archive

You have a **digital archive** containing **1,000 documents**. You want to locate documents that mention a specific topic.

a) You know that exactly **one document** contains the required information. How many documents do you need to check to find it? Consider the **minimum, maximum, and mean number of searches**.

b) There could be multiple documents that mention the topic, but you do not know how many. How many documents do you need to search to retrieve all relevant information? Consider the **minimum, maximum, and mean number of searches**.

c) Suppose the archive has a **search index**, which tells you that the topic appears in **documents 102, 435, and 789**.
How many documents do you need to examine using this index?

1. We have a continuous random variable Y that is uniformly distributed in the range [0,50]. What is the meaning of Y?

2. a) A storage bin can hold up to 15 books. If you have 250 books, what is the minimum number of storage bins required to store all of them?

b) You have 45 liters of juice in 3-liter bottles. You want to pour all the juice into containers that can hold up to 10 liters each. What is the minimum number of containers you need?

c) You need to store rubber balls with a diameter of 50mm. Each box can hold balls up to a height of 100mm, width of 100mm, and length of 450mm. What is the minimum number of boxes required to store 200 balls?

3. You have a PDF document with 500 pages, and you are searching for all references to a specific term. The references could be randomly placed across pages.
    a) If there is exactly one page that contains this term, how many pages would you need to search? Consider the minimum, maximum, and mean number.

b) If the term could appear on any number of pages, but you don't know how many, how many pages would you need to search to find all references? Consider the minimum, maximum, and mean number.

c) Suppose the last page contains a keyword index, listing all pages with references for various terms, and it specifies that the term appears on pages 101, 235, and 432. Using the index, how many pages do you need to search to find all references to the term?