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**CS 5600 – CRN: 13892**

1. **The student data file contains the following attributes:**

* **Id: Integer (2 bytes)**
* **Name: Varchar (16) (16 bytes)**
* **Age: Integer (2 bytes)**
* **Phone: Varchar (10) (bytes)**

**There are 1,000 records in this data file. We want to store the data file in a hard drive with the block(page) size = 512 bytes.**

**(Note. Each record is a fixed length record.)**

* 1. **How many blocks or pages that need for storing this data file in a hard drive? (3 pts.)**

***Answer:***

Given block size is 512 Bytes.

Total size of each student record = 2+16+2+10 = 30 Bytes per record

Given total number of student records = 1000 records = 30\*1000 = 30000 bytes

*Number of records can be stored in one block = 512/30 =17.066 = 17 records*

Total number of blocks required to store 1000 Student records

= 1000/17 = 58.8235 = *59 Blocks* required

**If we store the data file in MySQL, how many blocks or pages that need for the storing? (2 pts.)**

***Answer:***

Page Size in MySQL is 16KB = 16384 Bytes (1KB =1024Bytes)

*Number of records can be stored in one block = 16384/30 =546.1 = 546 records*

Total number of blocks required to store 1000 student records

=1000/546 =1.83 = *2 Blocks* required

1. **What are the similarities and differences between RAID 0 and RAID 1? (2 pts.)**

***Answer:***

RAID stands for Redundant Array of Independent Disk.

*Differences/ Similarities between RAID 0 and RAID 1:*

* RAID 0 is block level data striping without mirroring or parity and RAID 1 is data mirroring without parity or striping
* RAID 0 has no mirroring, hence there is no redundancy or fault tolerance. Whereas RAID 1 has mirroring, hence there is redundancy and fault tolerance
* Since there is no fault tolerance in RAID 0, if one HD fails, others will fail too but in RAID 1 if one HD fails, there is an identical HD as part of mirroring which we can recover the failed data
* Performance of RAID 1 is lower compared to RAID 0
* Storage space is 100% utilized in RAID 0 whereas in RAID 1 50% is utilized, other 50% is utilized for backup

1. **Show the buffer’s page allocation using the replacement policy: Least Recently Used-LRU**

**Where buffer size = 3 (3 pts.)**

**Program require: 4, 3, 2, 1, 4, 5, 3, 1, 2, 4**

***Answer:***

**M – Miss, H – Hit**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 |  | 3 |  | 2 |  | 1 |  | 4 |  | 5 |  | 3 |  | 1 |  | 2 |  | 4 |  |
| 4 |  | 4 |  | 4 |  | 1 |  | 1 |  | 1 |  | 3 |  | 3 |  | 3 |  | 4 |  |
|  |  | 3 |  | 3 |  | 3 |  | 4 |  | 4 |  | 4 |  | 1 |  | 1 |  | 1 |  |
|  |  |  |  | 2 |  | 2 |  | 2 |  | 5 |  | 5 |  | 5 |  | 2 |  | 2 |  |
| **M** |  | **M** |  | **M** |  | **M** |  | **M** |  | **M** |  | **M** |  | **M** |  | **M** |  | **M** |  |

Miss = 10; Hits = 0; Miss Rate = 10/10 = 100%

1. **Show the buffer’s page allocation using the replacement policy: Most Recently Used-MRU Where buffer size = 3 (3 pts.)**

**Program require: 1, 2, 4, 1, 2, 5, 3, 2, 4, 1**

***Answer:***

**M – Miss, H – Hit**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  | 2 |  | 4 |  | 1 |  | 2 |  | 5 |  | 3 |  | 2 |  | 4 |  | 1 |  |
| 1 |  | 1 |  | 1 |  | 1 |  | 1 |  | 1 |  | 1 |  | 1 |  | 1 |  | 1 |  |
|  |  | 2 |  | 2 |  | 2 |  | 2 |  | 5 |  | 3 |  | 2 |  | 2 |  | 2 |  |
|  |  |  |  | 4 |  | 4 |  | 4 |  | 4 |  | 4 |  | 4 |  | 4 |  | 4 |  |
| **M** |  | **M** |  | **M** |  | **H** |  | **H** |  | **M** |  | **M** |  | **M** |  | **H** |  | **H** |  |

Miss = 6; Hits = 4; Miss Rate = 60%, Hits Rate = 40%

1. **Create the B-Tree Index(m=4) after insert the following input index: (7 pts.)**

**12, 13, 10, 5, 6, 1, 2, 3, 7, 8, 9, 11, 4, 15, 19, 16, 14, 17.**

***Answer:***

m = 4

min = ⌈4/2⌉ = 2

A piece of paper with writing on it

Description automatically generated with medium confidence

Diagram, engineering drawing

Description automatically generated

Diagram, engineering drawing

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Diagram, engineering drawing

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Diagram, engineering drawing

Description automatically generated

Diagram, engineering drawing

Description automatically generated

1. **Regarding to the following B-Tree Index(m=4):**

**Diagram

Description automatically generated with medium confidence**

**If we delete index key 6, 3, and 7 what is the B-Tree Index after the deletion? (3 pts.)**

***Answer:***

Diagram, engineering drawing

Description automatically generated

Diagram

Description automatically generated

Diagram, engineering drawing

Description automatically generated

1. **Regarding to the following B-Tree Index(m=3):**

**Diagram

Description automatically generated**

**If we delete index key 11 and 5, what is the B-Tree Index after the deletion? (2 pts.)**

***Answer:***

Diagram

Description automatically generatedDiagram

Description automatically generated