WEEK 3

EXAMPLE OF TIME COMPLEXITY CALCULATION FOR A B+ TREE SEARCH

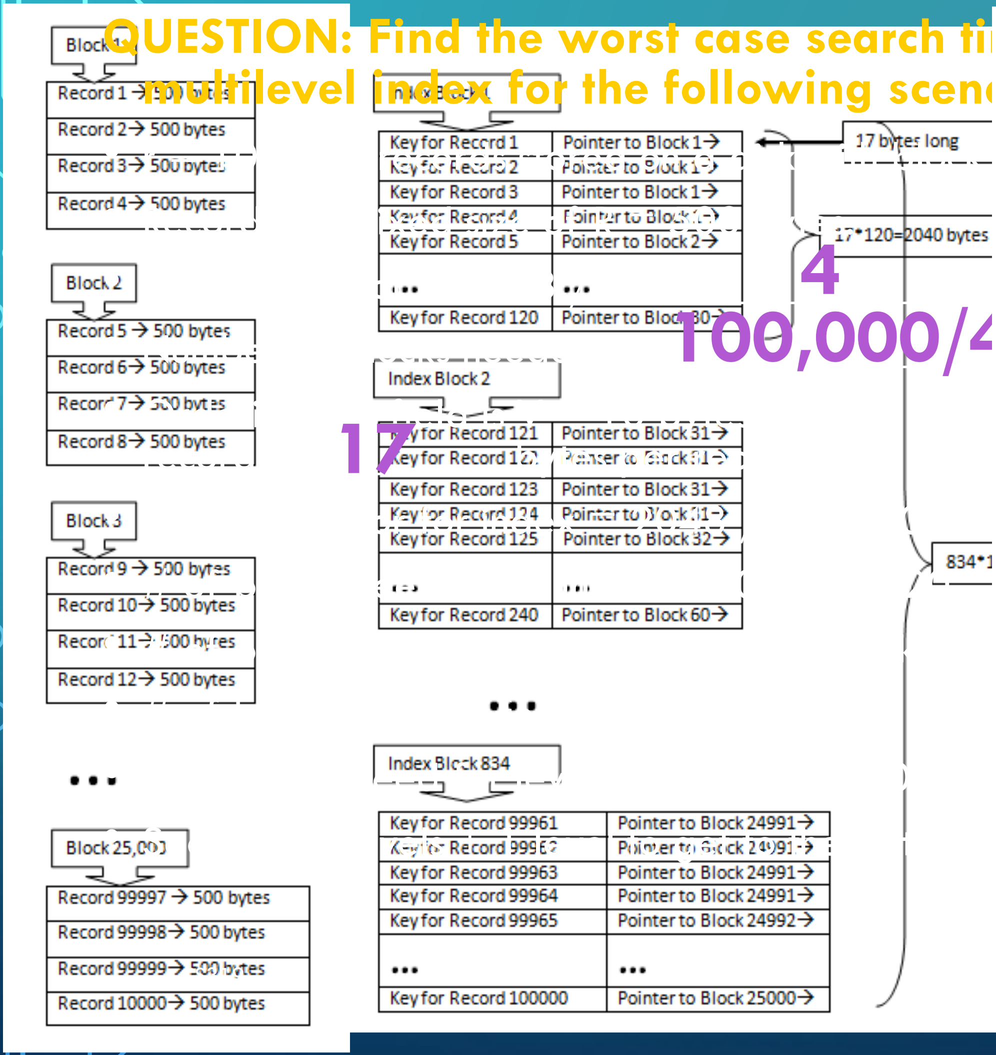
STUDENT OBJECTIVES

- Upon completion of this video, you should be able to:
  - Calculate the worse time for a search on a B+ tree structure for a given example.

QUESTION: Find the worst case search time to find a record if you use a multilevel index for the following scenario:

- r = 100,000 records stored on a disk with block size B = 2048 bytes.
- Records are fixed size of R = 500 bytes.
- Blocking Factor = 2048 / 500 = 4
- Number of blocks needed = 100,000/4 → 25,000
- Ordering key field is V = 10 bytes, a block pointer P = 7 bytes, thus size of the primary record is 17 bytes per record
- Blocking Factor for index = 2048 /17 =120 indices per block
- # of blocks needed for index = 100000/120 = 834
- # of blocks needed for level 1 = # of blocks needed for index = 834
- # of blocks needed for level 2 = level 1/ 120 = 834/120 → 7 blocks
- # of blocks need for level 3 = level 2 /120 = 7/120 → 1 block
- Search is 3 levels + 1 level to get to the data block = 4 Block accesses

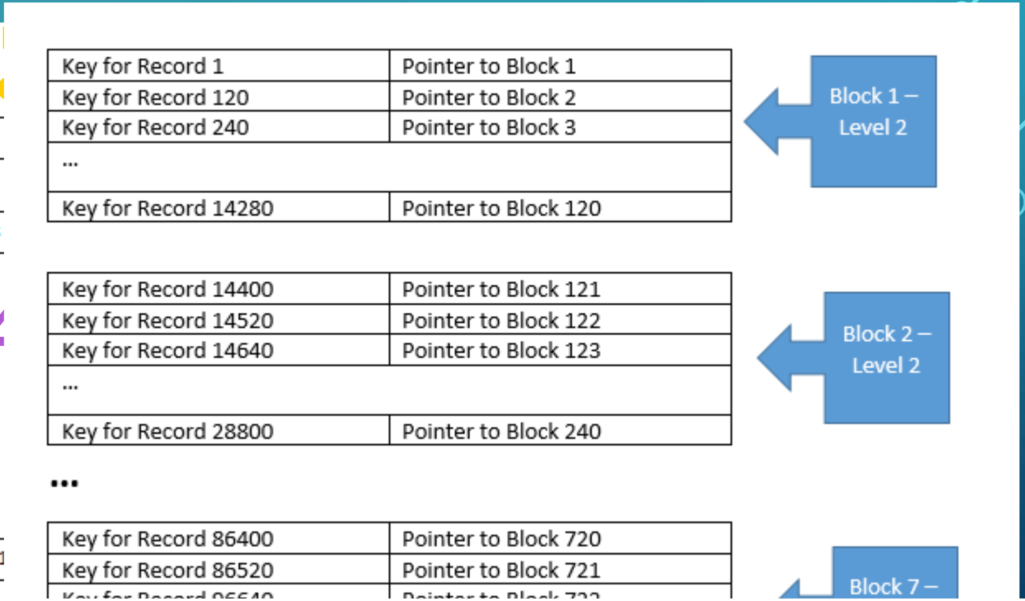
QUESTION: Find the worst case search ti multilevel index for the following scen



Index Block 1	
Key for Record 1	Pointer to Block 1 →
Key for Record 2	Pointer to Block 1 →
Key for Record 3	Pointer to Block 1 →
Key for Record 4	Pointer to Block 1 →
Key for Record 5	Pointer to Block 2 →
•••	•••
Key for Record 120	Pointer to Block 30 →

Index Block 2	
Key for Record 121	Pointer to Block 31 →
Key for Record 122	Pointer to Block 31 →
Key for Record 123	Pointer to Block 31 →
Key for Record 124	Pointer to Block 31 →
Key for Record 125	Pointer to Block 32 →
•••	•••
Key for Record 240	Pointer to Block 60 →

Index Block 834	
Key for Record 99961	Pointer to Block 24991 →
Key for Record 99962	Pointer to Block 24991 →
Key for Record 99963	Pointer to Block 24991 →
Key for Record 99964	Pointer to Block 24991 →
Key for Record 99965	Pointer to Block 24992 →
•••	•••
Key for Record 100000	Pointer to Block 25000 →



Block 1 – Level 2

Key for Record 1	Pointer to Block 1
Key for Record 120	Pointer to Block 2
Key for Record 240	Pointer to Block 3
…	
Key for Record 14280	Pointer to Block 120

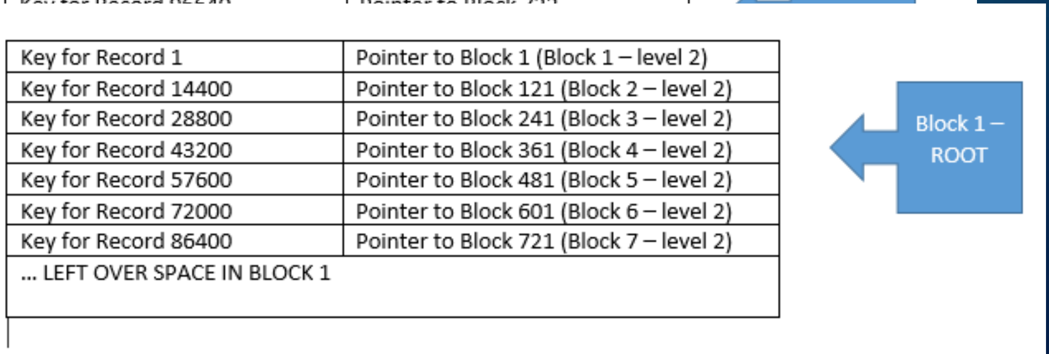
Block 2 – Level 2

Key for Record 14400	Pointer to Block 121
Key for Record 14520	Pointer to Block 122
Key for Record 14640	Pointer to Block 123
…	
Key for Record 28800	Pointer to Block 240

•••

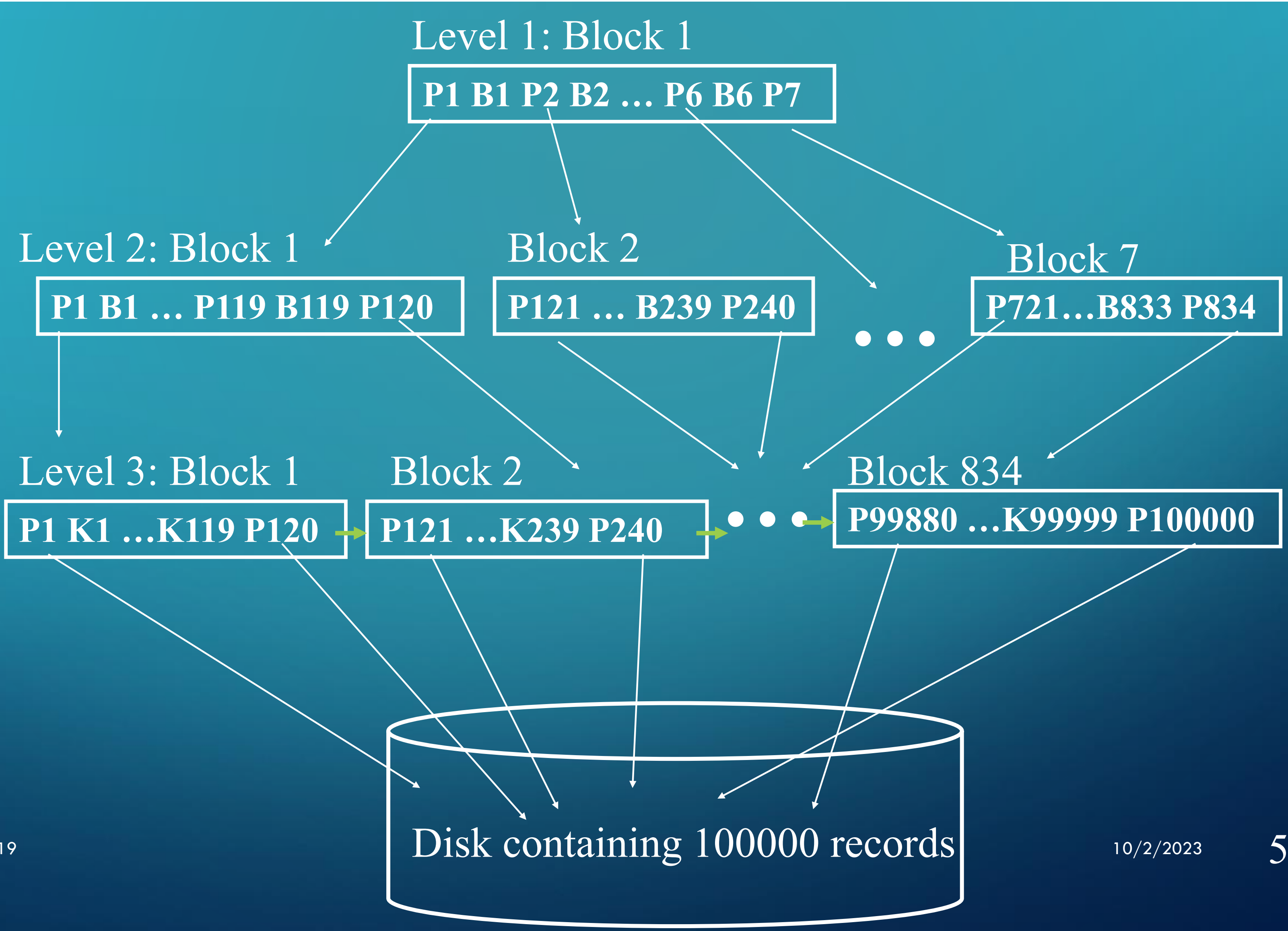
Block 7 –

Key for Record 86400	Pointer to Block 720
Key for Record 86520	Pointer to Block 721
Key for Record 86640	Pointer to Block 722



Block 1 – ROOT

Key for Record 1	Pointer to Block 1 (Block 1 – level 2)
Key for Record 14400	Pointer to Block 121 (Block 2 – level 2)
Key for Record 28800	Pointer to Block 241 (Block 3 – level 2)
Key for Record 43200	Pointer to Block 361 (Block 4 – level 2)
Key for Record 57600	Pointer to Block 481 (Block 5 – level 2)
Key for Record 72000	Pointer to Block 601 (Block 6 – level 2)
Key for Record 86400	Pointer to Block 721 (Block 7 – level 2)
… LEFT OVER SPACE IN BLOCK 1	



Level 1: Block 1

P1 B1 P2 B2 … P6 B6 P7

Level 2: Block 1

P1 B1 … P119 B119 P120

Block 2

P121 … B239 P240

• • •

Block 7

P721…B833 P834

Level 3: Block 1

P1 K1 …K119 P120

Block 2

P121 …K239 P240

• • •

Block 834

P99880 …K99999 P100000

Disk containing 100000 records