## Operációs rendszerek BSc

12. Gyak. 2022. 05. 02.

## Készítette:

Bodnár László Bsc Mérnökinformatikus D1H8VP

## Miskolc, 2022

**1. feladat** – "Adott egy igény szerinti lapozást használó rendszerben a következő laphivatkozás, amely 3, ill. 4 fizikai memóriakeretet igényel a processzek számára. Laphivatkozások sorrendje: 7, 6, 5, 4, 6, 7, 3, 2, 6, 7, 6, 5, 1, 2, 5, 6, 7, 6, 5, 2, Memóriakeret (igényelt lapok): 3, ill. 4 memóriakeret. Mennyi laphiba keletkezik (három és négy memóriakeret esetén) az alábbi algoritmusok esetén: FIFO, OPT, LRU és SC? Hasonlítsa össze és magyarázza az eredményeket.

|                       | Г |          |            |            | 3          | Fiz        | ikai       | im         | em  | ór   | iak          | er           | et                   |            |               |            |            |     | 7     |            |    |     |                  |     |    |                 |       |            | 4          | Fizi               | kai                 | me            | mé                     | ória | ke                | ret               |                   |     |                   |                   |                         | 1          |                   |                   |   |
|-----------------------|---|----------|------------|------------|------------|------------|------------|------------|-----|------|--------------|--------------|----------------------|------------|---------------|------------|------------|-----|-------|------------|----|-----|------------------|-----|----|-----------------|-------|------------|------------|--------------------|---------------------|---------------|------------------------|------|-------------------|-------------------|-------------------|-----|-------------------|-------------------|-------------------------|------------|-------------------|-------------------|---|
|                       |   |          |            |            |            |            |            | FII        | FO  |      |              |              |                      |            |               |            |            |     |       |            |    |     |                  |     |    |                 |       |            |            |                    |                     | FI            | FO                     |      |                   |                   |                   |     |                   |                   |                         |            |                   |                   | ٦ |
| lgényelt lap          | 7 | 7 6      |            | 4          | 6          | 7          | 7          | 3          | 2 ( | 5    | 7            | 6            | 5                    | 1          | 2             | 5          | (          | 5   | 7     | 6          | 5  | 2   | Igényelt I       | р 7 | 7  | 6 5             | 5     | 1 6        | 5          | 7                  | 3                   | 2             | 6                      | 7    | 6                 | 5                 | 1                 | 1 : | 2                 | 5                 | 6                       | 7          | 6                 | 5                 | 2 |
| 1.lap                 | 7 | 7 6      | 7          | 4          | 4          | 4          | 1 4        | 1 :        | 2 : | 2 :  | 2            | 2            | 5                    | 5          | 5             | 5          | (          | 5   | 6     | 6          | 6  | 2   | 1.lap            | 7   | 7  | 7               | 7     | 7 7        | 7          | 7                  | 3                   | 3             | 3                      | 3    | 3                 | 5                 |                   | 5   | 5                 | 5                 | 5                       | 7          | 7                 | 7                 | 7 |
| 2.lap                 |   | 6        | (          | 6          | 6          | 7          | 7          | 7          | 7 ( | 5    | 6            | 6            | 6                    | 1          | 1             | 1          |            | ı   | 7     | 7          | 7  | 7   | 2.lap            |     |    | 6 6             | 5 (   | 5 (        | 5          | 6                  | 6                   | 2             | 2                      | 2    | 2                 | 2                 | - 1               | ı : | 1                 | 1                 | 1                       | 1          | 1                 | 5                 | 5 |
| 3.lap                 |   |          | 5          | 5 5        | 5          | 5          | 5          | 3          | 3   | 3    | 7            | 7            | 7                    | 7          | 2             | 2          | :          | 2   | 2     | 2          | 5  | 5   | 3.lap            |     |    |                 | - 1   | 5 5        |            | 5                  | 5                   | 5             | 6                      | 6    | 6                 | 6                 | - 6               | 5   | 2                 | 2                 | 2                       | 2          | 2                 | 2                 | 2 |
| Laphiba               | • | •        | •          | •          |            | ٠          | •          | •          | 1   | •    | Т            | •            | 1.                   | 1          |               |            | •          | ·   | Т     | T          | T  | •   | 4.lap            |     | П  |                 |       | 1 4        |            | 4                  | 4                   | 4             | 4                      | 7    | 7                 | 7                 | 7                 | 7   | 7                 | 7                 | 6                       | 6          | 6                 | 6                 | 6 |
|                       |   |          |            |            |            |            |            |            |     | ŀ    | F            | H            | Ŧ                    | -          | -             |            |            | F   | F     | Ŧ          | -  |     | Laphiba          | ٠   | ٠  | •               | ٠     |            |            | ٠                  | ٠                   | •             | _                      | •    |                   | ٠                 | ٠                 | ٠   |                   | •                 | •                       | L          | ٠                 |                   | l |
|                       |   |          |            |            |            |            |            | L          |     |      |              |              |                      |            |               |            |            |     |       |            |    |     |                  |     |    |                 |       |            |            |                    |                     | ļ             |                        |      |                   |                   |                   |     |                   |                   |                         |            |                   |                   | _ |
|                       |   |          |            |            |            |            |            | 1 0        | PT  |      | _            | _            | -1                   |            | -1            | _          |            |     |       | -1         | -1 | _   |                  |     |    |                 | _     |            |            | _                  | 2                   | <del>ار</del> | PT                     | _    | _                 | 5                 |                   |     |                   |                   | -1                      |            | -                 |                   | Ⅎ |
| Igényelt lap          | - | 7 6      |            | -          | 7          | , ,        | 1          | , .        | -   | 7    |              | -            | 5                    | 5          | 5             | 5          | _          | 1   |       | 5          | 5  | 2   | Igényelt I       | P   |    | 7 :             | _     |            |            | 4                  | ,                   | 7             | 7                      | 4    | 6                 | - 5               |                   | -   | 4                 | 5                 | 6                       | _          |                   | 7                 | 4 |
| 1.lap                 | + | 6        |            | -          | ,          | ,          | ,          | -          | /   | 5    | -            | -            | 6                    | 1          | $\rightarrow$ | 1          | -          | -   |       | 6          | 6  | 6   | 1.lap            | +-  | -  | 6 6             |       | _          | 1          | 6                  | _                   | -             | 6                      | 6    | 6                 | - 6               | -                 | -   | 6                 | 6                 | 6                       | 4          | -                 | 6                 | 4 |
| 2.lap<br>3.lap        | ╫ | 1        | 1          |            | _          | _          |            |            | 2   |      | -            |              | 2                    | 2          | 2             | 2          |            | -   | -     | 7          | 7  | 9   | 2.lap<br>3.lap   | +   | +  | 6 6             |       |            | -          |                    |                     | 5             | 5                      | 5    | 5                 | 5                 |                   |     | -                 |                   |                         |            | -                 | 5                 | 0 |
| Laphiba               | - | -        |            | -          | -          |            |            |            | 4   | -    | -            | •            | <del>-</del>         | 4          | -             |            | -          |     | +     | +          | -1 |     | 4.lap            | +   | +  | +               | -     |            | -          | 4                  | -                   | -             | 2                      | 2    | 2                 | 2                 | -                 | +   | -                 | -                 | -                       | -          | -                 | 2                 | 즼 |
| Lapniba               | - | <u> </u> | Ė          | Ė          |            | H          |            | -          | +   | +    | t            | -            |                      | +          | _             |            | •          | •   | +     | +          |    | •   | 4.lap<br>Laphiba | +   | •  |                 | •     | 1          | +          | •                  | •                   | 2             | -                      | -2   | - 2               |                   | •                 | -   | 2                 | 2                 | •                       | 2          | 2                 | 2                 | - |
|                       |   |          | _          |            |            | _          |            | _          | RU  |      | _            | _            | _                    | _          | _             |            | _          | _   | _     | _          | _  |     |                  |     | _  |                 |       | _          | _          | _                  | _                   | _             | RU                     | _    |                   |                   |                   | _   | _                 | _                 |                         | _          | _                 |                   | ٦ |
| lgényelt lap          |   | , ,      |            | _          | _ `        | -          | 1 :        | _          | _   | 5    | -            | -            | 5                    | 1          | 2             | 5          | _          | -   |       | 6          | 5  | 2   | Igényelt I       |     |    | 6 :             |       | '          | -          |                    |                     | 2             | 6                      | 7    | 6                 |                   |                   |     | +                 | _                 | 6                       | -          | -                 | 5                 | 2 |
| 1.lap                 | 1 | ,        |            | -          | -          | _          | ,          |            | 3   | _    | _            | •            | 7                    | 1          | 1             | 1          |            |     |       | 6          | 6  | 6   | 1.lap            | 1   | -  | 7 7             | _     | -          |            | -                  | _                   | -             | 7                      | 7    | 7                 | 7                 | -                 | -   | 1                 | _                 | _                       |            | _                 | 2                 | 2 |
| 2.lap<br>3.lap        | ╫ | 6        | 9          |            |            |            |            |            |     | 5    |              |              | 5                    | 5          | 5             | 2          |            |     |       | 7          | 7  | 2   | 2.lap            | ┰   | +  | 6 6             |       |            |            | -                  |                     | 3             | 3                      | 3    | 6                 | 5                 |                   |     | -                 |                   |                         |            |                   | 5                 | 5 |
|                       | ╬ |          |            | -          | -          |            | 1          | 1          | 1   | 1.   | -            | •            | -                    | 9          | 2             |            |            | 1   | 4     | 4          | 4  | . 2 | 3.lap            | ┰   | +  | -               | -     | _          | -          | -                  | -                   | -             | -                      | 2    | _                 |                   | -                 | -   | -                 | -                 | -                       | -          | -                 | -                 | 7 |
| Laphiba               |   | ·        | ·          | •          | _          | ·          | Ŀ          | ·          | ·   | ·    | +            | ۰            | - 1                  | -1         | -             |            | Ŀ          | ľ   | +     | +          | _  | _   | 4.lap            | +   | -  | -               | -     | 4          | -          | 4                  | 4                   | 2             | 2                      | 2    | 2                 | 2                 | 1                 |     | 1                 | 1                 | 1                       | 4          | 7                 | 7                 | 4 |
|                       |   |          |            |            |            |            |            |            |     |      |              |              |                      |            |               |            |            |     |       |            |    |     | Laphiba          | ľ   | Ė  | Ť               | Ė     |            |            | Ė                  | Ė                   |               | +                      |      |                   | Ė                 | Ė                 | Ė   |                   |                   | Ť                       |            |                   |                   | _ |
|                       |   |          |            |            |            |            |            |            |     |      |              |              |                      |            |               |            |            |     |       |            |    |     |                  |     |    |                 |       |            |            |                    |                     |               |                        |      |                   |                   |                   |     |                   |                   |                         |            |                   |                   |   |
|                       |   |          |            |            |            |            |            |            |     |      | ŀ            |              |                      |            |               |            |            | L   |       |            |    |     |                  |     |    |                 |       |            |            |                    |                     |               |                        |      |                   |                   |                   |     |                   |                   |                         |            |                   |                   |   |
|                       |   |          |            |            |            |            |            |            | SC  |      |              |              |                      |            |               |            |            |     |       |            |    |     |                  |     |    |                 |       |            |            |                    |                     |               | sc                     |      |                   |                   |                   |     |                   |                   |                         |            |                   |                   | I |
| lgényelt lap          |   | _ ~      |            |            | 6          | _          | 7 :        | 3 :        | 2 ( | 5    |              |              | 5                    | 1          | 2             | 5          |            |     |       | 6          | 5  | 2   | lgényelt l       |     |    | 6 !             |       | 1 6        | 5          | 7                  | _                   | 2             | 6                      | 7    | 6                 | 5                 | -                 | L   | _                 |                   | 6                       | -          | -                 | 5                 | 2 |
| lgényelt lap<br>1.lap |   | 7.1      | 7.1        | 4,1        | 4,1        | 4,1        | 4,1        | 2,1        | 2 ( | 1 2, | 1 2,         | 1 5,         | 1 5                  | 1 5        | ,1            | 5,1        | 6,1        | 6,: | 1 6,: | 1 6        | ,1 |     | lgényelt l       |     | 7. | 1 7.            |       |            | 1 7.       | 1 3.               | 1 3,1               | 2             | 6<br>1 3               |      | 3,1               | 5,1               | 5,1               | 5,1 | 2 5,1             | _                 | 1 7,1                   | 7,1        | 7,1               | 7,1               |   |
|                       |   | 7.1      | 7.1<br>6.1 | 4,1<br>6,0 | 4,1<br>6,1 | 4,1<br>6,0 | 4,1<br>3,1 | 2,1<br>3,0 | 2 ( | 1 2, | 1 2,<br>1 7, | 1 5,<br>1 7, | 1 5<br>0 7           | 1 5<br>0 2 | ,1<br>,1      | 5,1<br>2,1 | 6,1<br>2,0 | 6,: | 1 6,: | 1 6<br>0 5 | ,1 | 5,0 | <u> </u>         |     |    | .1 7.:<br>l 6,1 | 6,1   | 6,1        | 6,1        | 1 3.               | 1 3,1<br>2,1        | 2<br>3,       | 6<br>1 3<br>1 2        | ,1   | 3,1<br>2,1        | 5,1<br>2,0        | 5,1<br>1,1        | 1,1 | 5,1<br>1,1        | 5,:               | 1 7,1<br>1 1,0          | 7,1        | 7,1               | 7,1<br>5,1        | 1 |
| 1.lap                 |   | 7.1      | 7.1<br>6.1 | 4,1<br>6,0 | 4,1        | 4,1<br>6,0 | 4,1        | 2,1<br>3,0 | 2 ( | 1 2, | 1 2,<br>1 7, | 1 5,<br>1 7, | 1 5<br>0 7           | 1 5<br>0 2 | ,1<br>,1      | 5,1<br>2,1 | 6,1<br>2,0 | 6,: | 1 6,: | 1 6<br>0 5 | ,1 | 5,0 | 1.lap            |     | 7. | .1 7.:<br>l 6,1 | 1 7.: | 6,1<br>5,1 | 6,1<br>5,1 | 1 3.<br>6,0<br>5,0 | 1 3,1<br>2,1<br>5,0 | 2<br>3,       | 6<br>1 3<br>1 2        | ,1   | 3,1<br>2,1        | 5,1<br>2,0<br>6,0 | 5,1<br>1,1<br>6,0 | 1,1 | 5,1<br>1,1        | 5,:               | 1 7,1<br>1 1,0<br>1 2,0 | 7,1<br>1,0 | 7,1<br>5,1<br>2,0 | 7,1<br>5,1<br>2,1 | 1 |
| 1.lap<br>2.lap        |   | 7.1      | 7.1<br>6.1 | 4,1<br>6,0 | 4,1<br>6,1 | 4,1<br>6,0 | 4,1<br>3,1 | 2,1<br>3,0 | 2 ( | 1 2, | 1 2,<br>1 7, | 1 5,<br>1 7, | ,1 5<br>,0 7<br>,0 1 | 1 5<br>0 2 | ,1<br>,1      | 5,1<br>2,1 | 6,1<br>2,0 | 6,: | 1 6,: | 1 6<br>0 5 | ,1 | 5,0 | 1.lap<br>2.lap   |     | 7. | .1 7.:<br>l 6,1 | 6,1   | 6,1        | 6,1<br>5,1 | 1 3.<br>6,0<br>5,0 | 1 3,1<br>2,1<br>5,0 | 2<br>3,<br>2, | 6<br>1 3<br>1 2<br>1 6 | ,1 ( | 3,1<br>2,1<br>5,1 | 5,1<br>2,0<br>6,0 | 5,1<br>1,1        | 1,1 | 5,1<br>1,1<br>2,1 | 5,:<br>1,:<br>2,: | 1 7,1<br>1 1,0<br>1 2,0 | 7,1<br>1,0 | 7,1<br>5,1<br>2,0 | 7,1<br>5,1<br>2,1 | 1 |

**2. feladat** – Adott egy igény szerinti lapozást használó rendszerben a következő laphivatkozás, amely 3 fizikai memóriakeretet igényel a processzek számára. Laphivatkozások sorrendje: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 Memóriakeret (igényelt lapok): 3 memóriakeret. Mennyi laphiba keletkezik az alábbi algoritmusok esetén: FIFO, LRU, OPT? Hasonlítsa össze és magyarázza az eredményeket.

|              |   |   |   |   |   | 3 f | izik | ai n | nen | ıóri | ake | ret |   |   |   |   |   |   |   |   |
|--------------|---|---|---|---|---|-----|------|------|-----|------|-----|-----|---|---|---|---|---|---|---|---|
|              |   |   |   |   |   |     |      |      | FIF | 0    |     |     |   |   |   |   |   |   |   |   |
| Igényelt lap | 7 | 0 | 1 | 2 | 0 | 3   | 0    | 4    | 2   | 3    | 0   | 3   | 2 | 1 | 2 | 0 | 1 | 7 | 0 | 1 |
| 1.lap        | 7 | 7 | 7 | 2 | 2 | 2   | 2    | 4    |     | 4    | 0   | 0   | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 7 |
| 2.lap        |   | 0 | 0 | 0 | 0 | 3   | 3    |      |     | 2    | 2   | 2   | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 3.lap        |   |   | 1 | 1 | 1 | 1   | 0    | 0    | 0   | 3    | 3   | 3   | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 |
| Laphiba      | * | * | * | * |   | *   | *    | *    | *   | *    | *   |     |   | * | * |   |   | * | * | * |
|              |   |   |   |   |   |     |      |      |     |      |     |     |   |   |   |   |   |   |   |   |
|              |   |   |   |   |   |     |      |      | OP  | Т    |     |     |   |   |   |   |   |   |   |   |
| Igényelt lap | 7 | 0 | 1 | 2 | 0 | 3   | 0    | 4    | 2   | 3    | 0   | 3   | 2 | 1 | 2 | 0 | 1 | 7 | 0 | 1 |
| 1.lap        | 7 | 7 | 7 | 2 | 2 | 2   | 2    | 2    | 2   | 2    | 2   | 2   | 2 | 2 | 2 | 2 | 2 | 7 | 7 | 7 |
| 2.lap        |   | 0 | 0 | 0 | 0 | 0   | 0    | 4    |     | 4    | 0   | 0   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.lap        |   |   | 1 | 1 | 1 | 3   | 3    | 3    | 3   | 3    | 3   | 3   | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Laphiba      | * | * | * | * |   | *   |      | *    |     |      | *   |     |   | * |   |   |   | * |   |   |
|              |   |   |   |   |   |     |      |      |     |      |     |     |   |   |   |   |   |   |   |   |
|              |   |   |   |   |   |     |      |      |     |      |     |     |   |   |   |   |   |   |   |   |
|              |   |   |   |   |   |     |      |      | LRU | J    |     |     |   |   |   |   |   |   |   |   |
| Igényelt lap | 7 | 0 | 1 | 2 | 0 | 3   | 0    | 4    | 2   | 3    | 0   | 3   | 2 | 1 | 2 | 0 | 1 | 7 | 0 | 1 |
| 1.lap        | 7 | 7 | 7 | 2 | 2 | 2   | 2    | 4    | 4   | 4    | 0   | 0   | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2.lap        |   | 0 | 0 | 0 | 0 | 0   | 0    | 0    |     | 3    | 3   | 3   | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 3.lap        |   |   | 1 | 1 | 1 | 3   | 3    | 3    | 2   | 2    | 2   | 2   | 2 | 2 | 2 | 2 | 2 | 7 | 7 | 7 |
| Laphiba      | * | * | * | * |   | *   |      | *    | *   | *    | *   |     |   | * |   | * |   | * |   |   |