**DOCUMENTAȚIE**

TEMA 2

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1. **Obiectivul temei**

Obiectivul principal al temei este proiectarea și implementarea unei aplicații de gestionare a unor cozi care să atribuie clienți cozilor astfel încât timpul de așteptare să fie minimizat.

Obiective secundare:

1. Definirea unei clase care să stocheze informațiile privind clienții
2. Definirea unei clase care să stocheze informațiile privind cozile
3. Definirea unei clase care să aplice stratgia dorită (în cazul respectiv distribuirea clinților în funcție de timpul minimal)
4. Definirea unei clase care să gestioneze cozile și atribuirea clienților
5. Definirea unei clase care să gestioneze simularea din punct de vedere al timpului, generării clienților, respectiv crearea fișierului log.txt
6. Crearea unui GUI (graphical user interface) care să permită utilizatorilor să introducă toate datele necesare simulării, cum ar fi: numărul clienților, numărul cozilor, timpul maxim al simulării, etc.
7. Creare unui GUI secundar care să permită vizionarea în timp real a distribuirii clienților
8. Implementarea tuturor claselor astfel încât fiecare coadă să funcționeze pe propriul thread
9. **Analiza problemei, modelare, scenarii, cazuri de utilizare**

Cerințe funcționale:

1. Introducerea numărului de clienți, numărului de clienți, respectiv timpilor de simulare
2. Pornirea simulării
3. Afișarea parcursului simulării într-un fișier text
4. Afișarea parcursului simulării pe ecran, în timp real

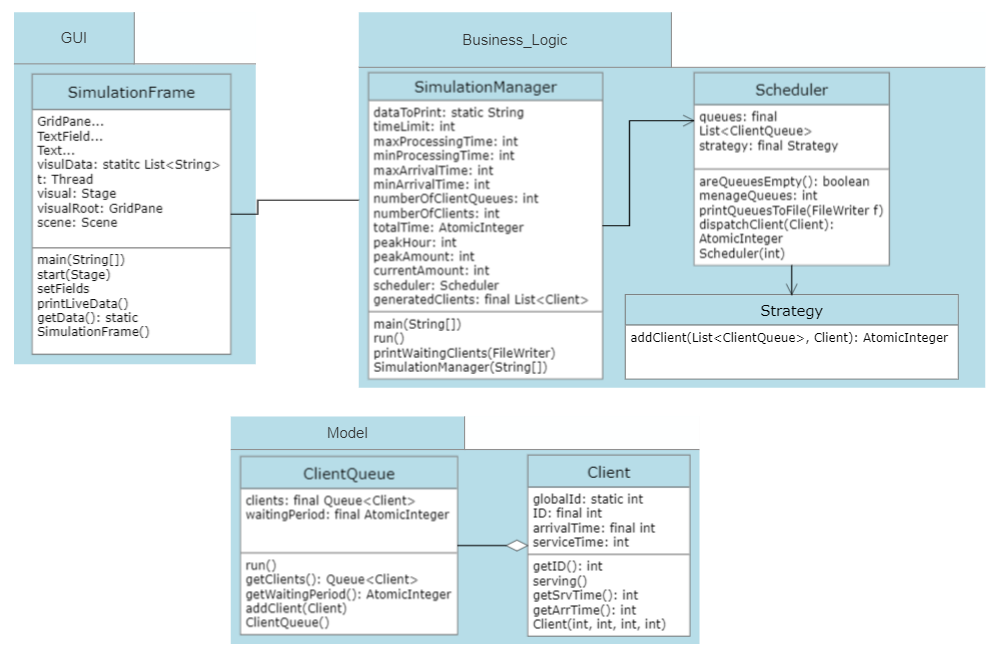
Cerințe non funcționale:

1. GUI-ul trebuie să fie unul plăcut la vedere și care să ofere utilizatorului un sentiment de familiaritate privind funcționalitatea aplicației

Cazurile de utilizare:

1. Introducerea datelor necesare
2. Se dechide aplicația
3. Se completează toate câmpurile de text
4. Executarea simulării
5. Se dechide aplicația
6. Se completează toate câmpurile de text
7. Se apasă pe butonul de pornire a simulării
8. **Proiectare**

Din punct de vedere al claselor, aplicația are la bază următoarea diagramă UML, formată din clasele *SimulationManager, SimulationFrame, Strategy, Scheduler, ClientQueue, Client*:



GUI-ul a fost implementat folosind JavaFX, având un total de 2 butoane și 7 câmpuri de text. Toate acestea au fost adăugate în interiorul unui *GridPane*, iar acțiunile butoanelor au fost setate folosind funcția *setOnAction().*

Pentru definirea clasei ClientQueue au fost utilizate structuri de tipul AtomicInteger și BlockingQueue cu scopul de a interzice thread-urilor să le acceseze în același timp, astfel rezolvând nenumărate probleme de sincronizare, care altfel ar face aplicația să creeze rezultate posibil greșite.

Pentru a face posibilă afișare în timp real a datelor pe GUI au fost folosite variabile și metode de tip static, astfel comunicarea între clasele *Simulation Frame* și *SimulationManager* find mult mai simplă și rapidă.

1. **Implementare**

Clasa SimulationFrame se va ocupa de tot ceea ce ține de inițializarea GUI-ului, efectuare citirilor și apelarea metodei main din SimulationManager la nevoie. Această clasă conține mai multe elemente de tip *Text*, *TextField*, respectiv *Button*, toate contribuind la rularea corectă a aplicației.

Clasa SimulationManager este cea care se află la baza programului, ocupându-se de gestionarea timpului curent al simulării, printarea în fișier a datelor corecte, respectiv transmiterea către SimulationFrame a datelor care necesită să fie afișate pe ecranul utilizatorului. Ea consta în mare parte de o colecție de *int*-uri care se ocupă cu administrarea tuturor sarcinilor. Clasa consta într-un constructor care inițializează toate variabilele și generează clienții, o metodă de scriere în fișier a datelor, respectiv o metodă *run* care se ocupă cu apelare clasei *Scheduler*.

Clasa Scheduler se ocupă cu alegerea strategiei utilizate, crearea cozilor de clienți și pornirea unui thread corespunzător fiecărui coadă. Este compusă dintr-un constructor care are rolurile menționate anterior, o metodă *dispatchClient* care apelează strategia curentă, plus o metodă care se ocupă de servirea clineților din cozi.

Clasa Strategy este constituită dintr-o singură metodă care are rolul de a adăuga un client la coada care are cel mai mic timp de așteptare, prin parcugerea fiecărei cozi și verificare parametrului *waitingPeriod*.

Clasa Client este cea mai simplă clasă dintre toate, având o singură metodă, constructorul, care se ocupă cu generarea unor numere aleatoare care să aparțină unor intervale primite.

Clasa ClientQueue este consituită dintr-un *BlockingQueue* de Client, și un timp de așteptare până la servirea ultimului client, acesta fiind incrementat de fiecare dată când un client nou este adăugat. Această clasă conține de asemenea metoda *run* care se ocupă cu gestionarea thread-ului din care face parte coada.

1. **Rezultate**

Test 1

Time 0

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 1

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 2

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 3

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 4

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 5

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 6

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 7

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 8

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 9

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 10

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 11

Waiting clients: (2,12,2);(3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 12

Waiting clients: (3,16,2);(1,17,2);(4,29,2);

Queue 1: (2,12,2);

Queue 2: closed

Time 13

Waiting clients: (3,16,2);(1,17,2);(4,29,2);

Queue 1: (2,12,1);

Queue 2: closed

Time 14

Waiting clients: (3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 15

Waiting clients: (3,16,2);(1,17,2);(4,29,2);

Queue 1: closed

Queue 2: closed

Time 16

Waiting clients: (1,17,2);(4,29,2);

Queue 1: (3,16,2);

Queue 2: closed

Time 17

Waiting clients: (4,29,2);

Queue 1: (3,16,1);

Queue 2: (1,17,2);

Time 18

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: (1,17,1);

Time 19

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 20

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 21

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 22

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 23

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 24

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 25

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 26

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 27

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 28

Waiting clients: (4,29,2);

Queue 1: closed

Queue 2: closed

Time 29

Waiting clients:

Queue 1: (4,29,2);

Queue 2: closed

Time 30

Waiting clients:

Queue 1: (4,29,1);

Queue 2: closed

Avg. waiting time: 2.0

Peak hour: TIME 17

Test 2

Time 0

Waiting clients: (2,2,4);(36,3,4);(38,3,1);(47,4,3);(5,5,2);(13,5,4);(50,5,4);(34,6,1);(1,7,1);(19,7,2);(35,7,6);(39,7,2);(42,7,4);(44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: closed

Queue 2: closed

Queue 3: closed

Queue 4: closed

Queue 5: closed

Time 1

Waiting clients: (2,2,4);(36,3,4);(38,3,1);(47,4,3);(5,5,2);(13,5,4);(50,5,4);(34,6,1);(1,7,1);(19,7,2);(35,7,6);(39,7,2);(42,7,4);(44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: closed

Queue 2: closed

Queue 3: closed

Queue 4: closed

Queue 5: closed

Time 2

Waiting clients: (36,3,4);(38,3,1);(47,4,3);(5,5,2);(13,5,4);(50,5,4);(34,6,1);(1,7,1);(19,7,2);(35,7,6);(39,7,2);(42,7,4);(44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (2,2,4);

Queue 2: closed

Queue 3: closed

Queue 4: closed

Queue 5: closed

Time 3

Waiting clients: (47,4,3);(5,5,2);(13,5,4);(50,5,4);(34,6,1);(1,7,1);(19,7,2);(35,7,6);(39,7,2);(42,7,4);(44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (2,2,3);

Queue 2: (36,3,4);

Queue 3: (38,3,1);

Queue 4: closed

Queue 5: closed

Time 4

Waiting clients: (5,5,2);(13,5,4);(50,5,4);(34,6,1);(1,7,1);(19,7,2);(35,7,6);(39,7,2);(42,7,4);(44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (2,2,2);

Queue 2: (36,3,3);

Queue 3: (47,4,3);

Queue 4: closed

Queue 5: closed

Time 5

Waiting clients: (34,6,1);(1,7,1);(19,7,2);(35,7,6);(39,7,2);(42,7,4);(44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (2,2,1);(50,5,4);

Queue 2: (36,3,2);

Queue 3: (47,4,2);

Queue 4: (5,5,2);

Queue 5: (13,5,4);

Time 6

Waiting clients: (1,7,1);(19,7,2);(35,7,6);(39,7,2);(42,7,4);(44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (50,5,4);

Queue 2: (36,3,1);(34,6,1);

Queue 3: (47,4,1);

Queue 4: (5,5,1);

Queue 5: (13,5,3);

Time 7

Waiting clients: (44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (50,5,3);

Queue 2: (34,6,1);(35,7,6);

Queue 3: (1,7,1);(39,7,2);

Queue 4: (19,7,2);(42,7,4);

Queue 5: (13,5,2);

Time 8

Waiting clients: (44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (50,5,2);

Queue 2: (35,7,6);

Queue 3: (39,7,2);

Queue 4: (19,7,1);(42,7,4);

Queue 5: (13,5,1);

Time 9

Waiting clients: (44,10,1);(8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (50,5,1);

Queue 2: (35,7,5);

Queue 3: (39,7,1);

Queue 4: (42,7,4);

Queue 5: closed

Time 10

Waiting clients: (8,11,1);(41,11,5);(32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (44,10,1);

Queue 2: (35,7,4);

Queue 3: closed

Queue 4: (42,7,3);

Queue 5: closed

Time 11

Waiting clients: (32,12,3);(25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (8,11,1);

Queue 2: (35,7,3);

Queue 3: (41,11,5);

Queue 4: (42,7,2);

Queue 5: closed

Time 12

Waiting clients: (25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (32,12,3);

Queue 2: (35,7,2);

Queue 3: (41,11,4);

Queue 4: (42,7,1);

Queue 5: closed

Time 13

Waiting clients: (25,14,5);(28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (32,12,2);

Queue 2: (35,7,1);

Queue 3: (41,11,3);

Queue 4: closed

Queue 5: closed

Time 14

Waiting clients: (28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (32,12,1);

Queue 2: (25,14,5);

Queue 3: (41,11,2);

Queue 4: closed

Queue 5: closed

Time 15

Waiting clients: (28,16,6);(37,16,1);(49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: closed

Queue 2: (25,14,4);

Queue 3: (41,11,1);

Queue 4: closed

Queue 5: closed

Time 16

Waiting clients: (49,17,4);(22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (28,16,6);

Queue 2: (25,14,3);

Queue 3: (37,16,1);

Queue 4: closed

Queue 5: closed

Time 17

Waiting clients: (22,18,1);(11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (28,16,5);

Queue 2: (25,14,2);

Queue 3: (49,17,4);

Queue 4: closed

Queue 5: closed

Time 18

Waiting clients: (11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (28,16,4);

Queue 2: (25,14,1);

Queue 3: (49,17,3);

Queue 4: (22,18,1);

Queue 5: closed

Time 19

Waiting clients: (11,20,1);(26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (28,16,3);

Queue 2: closed

Queue 3: (49,17,2);

Queue 4: closed

Queue 5: closed

Time 20

Waiting clients: (26,21,1);(27,21,2);(46,21,1);(21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (28,16,2);

Queue 2: (11,20,1);

Queue 3: (49,17,1);

Queue 4: closed

Queue 5: closed

Time 21

Waiting clients: (21,22,3);(9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (28,16,1);

Queue 2: (26,21,1);

Queue 3: (27,21,2);

Queue 4: (46,21,1);

Queue 5: closed

Time 22

Waiting clients: (9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (21,22,3);

Queue 2: closed

Queue 3: (27,21,1);

Queue 4: closed

Queue 5: closed

Time 23

Waiting clients: (9,24,7);(14,24,2);(20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (21,22,2);

Queue 2: closed

Queue 3: closed

Queue 4: closed

Queue 5: closed

Time 24

Waiting clients: (20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (21,22,1);

Queue 2: (9,24,7);

Queue 3: (14,24,2);

Queue 4: closed

Queue 5: closed

Time 25

Waiting clients: (20,26,5);(33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: closed

Queue 2: (9,24,6);

Queue 3: (14,24,1);

Queue 4: closed

Queue 5: closed

Time 26

Waiting clients: (33,27,3);(18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (20,26,5);

Queue 2: (9,24,5);

Queue 3: closed

Queue 4: closed

Queue 5: closed

Time 27

Waiting clients: (18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (20,26,4);

Queue 2: (9,24,4);

Queue 3: (33,27,3);

Queue 4: closed

Queue 5: closed

Time 28

Waiting clients: (18,29,5);(45,29,3);(6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (20,26,3);

Queue 2: (9,24,3);

Queue 3: (33,27,2);

Queue 4: closed

Queue 5: closed

Time 29

Waiting clients: (6,30,6);(10,30,7);(48,30,7);(7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (20,26,2);

Queue 2: (9,24,2);

Queue 3: (33,27,1);

Queue 4: (18,29,5);

Queue 5: (45,29,3);

Time 30

Waiting clients: (7,31,6);(17,31,2);(29,31,6);(4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (20,26,1);(10,30,7);

Queue 2: (9,24,1);(48,30,7);

Queue 3: (6,30,6);

Queue 4: (18,29,4);

Queue 5: (45,29,2);

Time 31

Waiting clients: (4,32,5);(31,32,2);(24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (10,30,7);

Queue 2: (48,30,7);

Queue 3: (6,30,5);(29,31,6);

Queue 4: (18,29,3);(17,31,2);

Queue 5: (45,29,1);(7,31,6);

Time 32

Waiting clients: (24,33,6);(16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (10,30,6);(31,32,2);

Queue 2: (48,30,6);

Queue 3: (6,30,4);(29,31,6);

Queue 4: (18,29,2);(17,31,2);(4,32,5);

Queue 5: (7,31,6);

Time 33

Waiting clients: (16,34,7);(30,34,6);(40,34,6);(43,34,6);(23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (10,30,5);(31,32,2);

Queue 2: (48,30,5);(24,33,6);

Queue 3: (6,30,3);(29,31,6);

Queue 4: (18,29,1);(17,31,2);(4,32,5);

Queue 5: (7,31,5);

Time 34

Waiting clients: (23,35,5);(3,38,1);(12,39,5);(15,39,3);

Queue 1: (10,30,4);(31,32,2);(30,34,6);

Queue 2: (48,30,4);(24,33,6);

Queue 3: (6,30,2);(29,31,6);(43,34,6);

Queue 4: (17,31,2);(4,32,5);(40,34,6);

Queue 5: (7,31,4);(16,34,7);

Time 35

Waiting clients: (3,38,1);(12,39,5);(15,39,3);

Queue 1: (10,30,3);(31,32,2);(30,34,6);

Queue 2: (48,30,3);(24,33,6);(23,35,5);

Queue 3: (6,30,1);(29,31,6);(43,34,6);

Queue 4: (17,31,1);(4,32,5);(40,34,6);

Queue 5: (7,31,3);(16,34,7);

Test 3

Time 0

Waiting clients: (7,10,9);(64,10,7);(563,10,3);(596,10,5);(716,10,4);(760,10,9);(868,10,3);(967,10,6);(983,10,3);(6,11,7);(48,11,6);(149,11,6);(380,11,9);(431,11,3);(437,11,3);(441,11,6);(534,11,7);(898,11,8);(87,12,4);(274,12,8);(333,12,7);(486,12,7);(574,12,4);(620,12,5);(652,12,6);(677,12,6);(691,12,4);(707,12,3);(710,12,9);(717,12,3);(848,12,9);(71,13,7);(193,13,6);(502,13,3);(662,13,8);(674,13,7);(787,13,8);(884,13,6);(957,13,3);(18,14,8);(219,14,5);(278,14,3);(434,14,3);(619,14,6);(635,14,9);(651,14,6);(794,14,9);(913,14,6);(920,14,6);(51,15,6);(152,15,6);(245,15,7);(423,15,4);(448,15,3);(480,15,6);(562,15,9);(569,15,7);(586,15,9);(648,15,6);(676,15,3);(753,15,6);(814,15,7);(894,15,3);(924,15,5);(27,16,3);(83,16,9);(89,16,7);(163,16,3);(237,16,4);(254,16,7);(360,16,4);(417,16,5);(575,16,9);(591,16,7);(637,16,9);(690,16,5);(733,16,5);(744,16,6);(837,16,6);(895,16,5);(918,16,3);(85,17,5);(110,17,5);(199,17,7);(207,17,9);(325,17,6);(346,17,4);(355,17,8);(492,17,9);(561,17,4);(582,17,9);(705,17,4);(712,17,8);(821,17,6);(829,17,5);(934,17,5);(961,17,4);(74,18,3);(178,18,6);(229,18,4);(504,18,7);(572,18,7);(873,18,8);(114,19,9);(164,19,7);(173,19,8);(326,19,8);(638,19,8);(994,19,6);(30,20,5);(40,20,6);(138,20,3);(382,20,3);(462,20,9);(508,20,9);(598,20,7);(719,20,8);(818,20,3);(820,20,6);(911,20,4);(939,20,4);(973,20,8);(10,21,9);(12,21,3);(112,21,4);(123,21,5);(189,21,7);(253,21,4);(257,21,6);(343,21,9);(348,21,5);(349,21,3);(351,21,4);(374,21,6);(482,21,6);(489,21,5);(506,21,8);(510,21,7);(525,21,7);(537,21,4);(600,21,3);(769,21,9);(784,21,6);(832,21,9);(78,22,8);(135,22,6);(174,22,3);(216,22,8);(361,22,7);(368,22,6);(406,22,5);(702,22,4);(718,22,6);(827,22,6);(921,22,5);(949,22,4);(962,22,4);(42,23,5);(80,23,3);(279,23,5);(367,23,5);(438,23,7);(439,23,7);(606,23,4);(658,23,6);(804,23,4);(11,24,4);(19,24,4);(104,24,4);(113,24,5);(132,24,7);(151,24,6);(231,24,9);(307,24,8);(315,24,4);(507,24,3);(541,24,4);(597,24,7);(650,24,7);(845,24,4);(851,24,9);(953,24,6);(105,25,7);(232,25,5);(247,25,6);(275,25,4);(344,25,3);(410,25,5);(540,25,4);(581,25,7);(697,25,6);(708,25,6);(722,25,5);(795,25,7);(824,25,7);(917,25,3);(938,25,8);(171,26,3);(202,26,6);(366,26,8);(660,26,8);(872,26,9);(880,26,7);(180,27,8);(397,27,4);(519,27,6);(678,27,7);(689,27,3);(727,27,6);(776,27,5);(16,28,7);(210,28,8);(217,28,7);(269,28,4);(443,28,6);(490,28,7);(493,28,3);(685,28,8);(779,28,3);(993,28,5);(43,29,8);(125,29,9);(166,29,6);(331,29,8);(350,29,9);(551,29,4);(636,29,4);(642,29,6);(764,29,9);(992,29,6);(36,30,6);(84,30,6);(165,30,3);(184,30,5);(270,30,8);(338,30,9);(381,30,6);(457,30,6);(793,30,8);(893,30,3);(950,30,9);(951,30,6);(21,31,3);(327,31,6);(354,31,7);(379,31,4);(433,31,5);(436,31,8);(952,31,7);(33,32,8);(301,32,6);(340,32,3);(365,32,8);(407,32,4);(413,32,8);(843,32,8);(999,32,4);(2,33,4);(158,33,8);(530,33,7);(667,33,9);(82,34,6);(182,34,4);(505,34,7);(601,34,6);(729,34,3);(867,34,4);(902,34,9);(169,35,9);(302,35,4);(447,35,6);(488,35,8);(668,35,3);(709,35,3);(751,35,5);(943,35,9);(128,36,9);(285,36,9);(286,36,8);(415,36,7);(531,36,6);(549,36,7);(728,36,7);(24,37,8);(116,37,5);(271,37,5);(341,37,8);(352,37,4);(471,37,5);(472,37,6);(500,37,9);(571,37,6);(613,37,6);(644,37,3);(645,37,3);(698,37,9);(788,37,8);(907,37,8);(65,38,4);(172,38,4);(324,38,3);(398,38,9);(496,38,9);(498,38,5);(720,38,6);(32,39,9);(121,39,7);(177,39,5);(458,39,8);(469,39,7);(627,39,7);(766,39,8);(878,39,3);(885,39,9);(948,39,5);(5,40,8);(111,40,9);(201,40,6);(265,40,7);(395,40,4);(412,40,8);(449,40,6);(535,40,4);(618,40,3);(741,40,9);(752,40,7);(888,40,4);(912,40,9);(978,40,5);(56,41,6);(273,41,5);(295,41,6);(399,41,8);(435,41,9);(445,41,9);(639,41,5);(669,41,7);(673,41,4);(675,41,6);(693,41,8);(791,41,6);(819,41,4);(980,41,3);(102,42,3);(204,42,5);(291,42,7);(414,42,5);(420,42,7);(643,42,4);(656,42,5);(665,42,7);(810,42,4);(863,42,3);(922,42,7);(970,42,7);(93,43,4);(211,43,8);(316,43,6);(369,43,5);(388,43,3);(593,43,8);(688,43,4);(731,43,8);(745,43,9);(904,43,4);(910,43,3);(935,43,7);(972,43,3);(282,44,4);(353,44,8);(481,44,3);(483,44,8);(521,44,7);(633,44,3);(724,44,9);(773,44,3);(801,44,9);(866,44,5);(925,44,8);(66,45,8);(72,45,4);(223,45,6);(599,45,9);(700,45,6);(817,45,4);(826,45,5);(859,45,9);(936,45,4);(67,46,5);(205,46,3);(225,46,7);(263,46,8);(421,46,9);(450,46,3);(499,46,8);(554,46,4);(626,46,9);(629,46,7);(664,46,6);(841,46,5);(869,46,9);(960,46,6);(20,47,5);(198,47,8);(244,47,7);(309,47,8);(314,47,9);(364,47,6);(514,47,5);(532,47,9);(533,47,4);(671,47,7);(737,47,6);(900,47,5);(37,48,5);(91,48,7);(120,48,3);(228,48,8);(657,48,9);(748,48,7);(802,48,8);(865,48,3);(896,48,5);(63,49,4);(109,49,3);(136,49,6);(167,49,8);(401,49,8);(594,49,3);(611,49,5);(883,49,7);(931,49,9);(256,50,6);(386,50,4);(452,50,8);(713,50,6);(763,50,8);(768,50,5);(774,50,6);(823,50,9);(854,50,4);(976,50,4);(94,51,3);(117,51,6);(168,51,6);(305,51,6);(442,51,4);(557,51,4);(573,51,9);(29,52,8);(183,52,3);(200,52,5);(243,52,5);(252,52,6);(300,52,5);(357,52,7);(387,52,5);(543,52,8);(603,52,9);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Queue 1: closed

Queue 2: closed

Queue 3: closed

Queue 4: closed

Queue 5: closed

Queue 6: closed

Queue 7: closed

Queue 8: closed

Queue 9: closed

Queue 10: closed

Queue 11: closed

Queue 12: closed

Queue 13: closed

Queue 14: closed

Queue 15: closed

Queue 16: closed

Queue 17: closed

Queue 18: closed

Queue 19: closed

Queue 20: closed

Testele 2 și 3 nu sunt incluse în totalitate în acest document, ele se pot regăsi atașate împreună cu celălalt test pe repo-ul unde a fost publicat proiectul.

1. **Concluzii**

Această temă a ajutat la dezvoltarea cunoștințelor atât de Java cât și de JavaFX, dar pe lângă acestea ne-a ajutat să înțelegem mai bine procesul prin care se dezvoltă o aplicație care are scopul de a fi utilizată de cât mai multă lume. Ne-a ajutat să înțelegem în detaliu mai mare cum funcționează thread-urile și în ce moduri pot fi acestea folositoare dacă le folosim corect.

Cu toate acestea, aplicația nu este în niciun caz perfectă, ea ar putea beneficia de multe îmbunătățiri atât din punct de vedere al codului cât și al GUI-ului. Ex: GUI-ului ar avea nevoie de un *polish*, codul ar putea fi mai eficient.

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