

**Organizarea cozilor utilizand threaduri si mecanisme de sincronizare**

**Documentatie**

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***1.Obiectivul temei:***

* Obiectivul principal al temei “Organizarea cozilor utilizand threaduri si mecanisme de sincronizare” consta in proiectarea si implementarea unui simulator de cozi cu o interfata grafica si un log file ce are ca scop analiza sistemelor bazate pe cozi prin assignarea unui numar N de clienti la Q cozi de marcat si analiza timpului mediu de asteptare, timpului mediu de servire si orei de varf.
* Indeplinirea obiectivului principal necesita indeplinirea unor obiective secundare:

1. Analizarea problemei si identificarea cerintelor:

* Pentru a putea implementa aplicatia trebuie intai sa avem o idee concreta a ce ne dorim de la aceasta. Astfel, intelegerea metodei de functionare a threadurilor este cruciala.
* Dezvoltarea acestui subiect se afla in capitolul 2

1. Identificarea si solutionarea cazurilor de utilizare ale aplicatiei din ceea ce priveste interactiunea utilizatorului cu aceasta:

* Este necesar sa acoperim toate cazurile de utilizare astfel incat aplicatia sa functioneze cum trebuie in orice circumstanta
* Dezvoltarea acestui subiect se afla in capitolul 2

1. Dezvoltarea si proiectarea aplicatiei conform cerintelor din barem respectand paradigmele programarii orientate pe obiecte:

* Se descriu structurile de date si algoritmii utilizati in implementare (capitolul 3 si 4)
* Se prezinta structurarea aplicatiei in pachete, clase si relatiile dintre acestea ( capitolul 3 si 4)
* Se vor utiliza diagrame UML pentru exemplificarea legaturilor dintre componente

1. Evaluarea rezultatelor obtinute:

* Se va analiza continutul fisierului logs.txt
* Dezvoltarea acestui subiect se afla in capitolul 5

***2.Analiza problemei; Modelare; Scenarii; Cazuri de utilizare:***

Cerinta problemei este: “Proiectati si implementati un simulator de cozi ce analiza timpul mediu de asteptare, timpul mediu de servire si ora de varf”.

Pentru rezolvarea acestei problemei intai ne trebuie o suita de cunostinte legate de sistemul de multithreading al unui calculator:

Principiul de multithreading presupune execuția mai multor thread-uri în același pipeline, fiecare având propria secțiune de timp în care este menit să lucreze. Odată cu creșterea capabilităților procesoarelor au crescut și cererile de performanță, asta ducând la solicitarea la maxim a resurselor unui procesor. Necesitatea multithreading-ului a venit de la observația că unele procesoare puteau pierde timp prețios în așteptarea unui eveniment pentru o anumită sarcină.

Un procesor cu mai multe fire de execuție, capabil să proceseze multiple instrucțiuni din surse diferite poartă numele de procesor cu multithreading simultan.

Pentru a putea beneficia de avantajele multithreading-ului, un program trebuie să poată fi despărțit în secțiuni ce pot rula independent și în mod paralel, fiind foarte greu de utilizat în codul reprezentat de o înșiruire foarte lungă de instrucțiuni. Gestiunea firelor de execuție este controlată de sistemul de operare.

***Cazuri de utilizare:***

* Cazurile de uitlizare vor fi evidentiate prin daigrama use-case,

unde Actorul este reprezentat de orice utilizator al aplicatiei

Diagram

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Rularea aplicatiei de simulare a cozilor

Use-case: Introducerea parametrilor de simulare, vizualizarea evolutiei simularii, vizualizarea statisticilor obtinute.

Primary actor: Utilizatorul

Main success scenario:

Utilizatorul introduce datele corespunzatoare parametrilor necesari simularii.

Interpretarea datelor utilzatorului.

Inceperea simularii intr-o fereastra dedicata acesteia ce va afisa evolutiile cozilor si a taskurilor simularii intr-un textbox si intr-un log file.

Dupa terminarea timpului de simulare se vor afisa rezultatele statistice la finalul textBoxului

Alternative sequences:

Introducerea de paramentri incorecti pentru simulare, caz in care va aparea un mesaj de eroare.

***3.Proiectare***

Acest capitol va prezenta diagramele UML pentru pachete si pentru clase.

Diagrama UML pentru package-uri:

Diagram

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Diagrama UML pentru clase:

Graphical user interface, table, Excel

Description automatically generatedA piece of paper with writing on it

Description automatically generated with low confidence

***4.Implementare***

Aplicatia contine 7 clase :

1. Clasa Clienti:

* Are 3 atribute: id-ul clientului, timpul la care clientul se pune la o coada si durata de procesare a clientului.
* Metode:
* *CompareTo:* Este folosit in sortarea listelor cu elemente de tip Client
* *Getters and setters:* Folositi pentru accesarea datelor
* *ToString:* Translateaza datele clientului intr-o forma citibila

Text

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1. Clasa CasaMarcat:

* Are 4 atribute: id-ul casei de marcat, coada de clienti de la aceasta casa, reprezentata de un LinkedBlockingQueue, timpul total de asteptare al casei, reprezentat de un atomic integer si threadul caracteristic al casei de marcat
* Metode:
* *Getters and setters:* Folositi pentru accesarea datelor
* *addClient:* adauga un client in coada si incrementeaza timpul total de asteptare al clasei cu valoarea de procesare a clientului
* *run:* metoda aceasta este apelata la pornirea threadului si proceseaza clientii din coada in ordinea sosirii lor

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1. Clasa ConcreteStrategyTime:

* Implementeaza interfata Strategy
* Nu are atribute
* Metode:
* *addTask:* alege coada la care un client ar trebui sa mearga, prioritizand coada cu cel mai mic timp de asteptare

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1. Clasa Scheduler:

* Are 3 atribute: numarul de case de marcat, lista ce contine casele de marcat, de tip ArrayList, si strategia aplicata de scheduler
* Metode:
* *Getters and setters:* Folositi pentru accesarea datelor
* *dispatchTask:* apeleaza strategia aleasa pentru a trimite clientul primit ca parametru la o casa de marcat
* *changeStrategy:* schimba strategia curenta cu cea primita ca parametru

Graphical user interface, text

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1. Clasa SimulationManager:

* Are 12 atribute: time Limit, max Processing Time,

Min Processing Time, max Selection Time, min Selection Time,

numarCase si numarClienti sunt datele standard introduse de

utilizator, textArea si button contribuie aducerii de modificari

in interfata, scheduler ce este utilizat pentru a putea utiliza functiile

din scheduler, clientiGenerati stocheaza clientii generati cu date

aleatoare si thread reprezinta threadul reprezentativ managerului de

de simulari

* Metode:
* *GenereazaNClienti:* Folosit pentru a genera

numarClienti numar de clienti avand ca timp de sosire si timp de procesare valori aleatoare intre min Processing Time si max Processing Time respectiv intre min Selection time si max Selection Time

* *run:* Este apelat odata cu pornirea threadului si face scrierea in interfata si in log file, avanseaza timpul curent, selecteaza clientii cu timpul de sosire egal cu timpul curent si ii transmite dispatch taskului, calculeaza

average time, average selection si peak hour apoi decrementeaza waiting time-ul total din casele de marcat.

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***5.Rezultate***

Date intrare:

* nr. Clienti: 25
* nr. Case de marcat: 3
* Min Arrival Time: 0
* Max Arrival Time: 20
* Min Selection Time: 2
* Max Selection Time: 8
* Time Limit: 45

Log file-ul rezultat:

1:   
Waiting clients: (12, 2, 5) (13, 3, 2) (15, 3, 7) (5, 5, 6) (20, 5, 3) (17, 6, 8) (3, 7, 7) (22, 8, 3) (4, 9, 7) (8, 9, 5) (9, 9, 5) (10, 10, 3) (24, 10, 8) (16, 12, 7) (23, 12, 8) (11, 13, 6) (18, 16, 2) (1, 17, 7) (21, 17, 2) (14, 18, 8) (7, 20, 7)   
Casa1: (2, 1, 5)   
Casa2: (6, 1, 2) (25, 1, 2)   
Casa3: (19, 1, 2)   
2:   
Waiting clients: (13, 3, 2) (15, 3, 7) (5, 5, 6) (20, 5, 3) (17, 6, 8) (3, 7, 7) (22, 8, 3) (4, 9, 7) (8, 9, 5) (9, 9, 5) (10, 10, 3) (24, 10, 8) (16, 12, 7) (23, 12, 8) (11, 13, 6) (18, 16, 2) (1, 17, 7) (21, 17, 2) (14, 18, 8) (7, 20, 7)   
Casa1: (2, 1, 5)   
Casa2: (6, 1, 2) (25, 1, 2)   
Casa3: (19, 1, 2) (12, 2, 5)   
3:   
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Casa1: (2, 1, 5) (15, 3, 7)   
Casa2: (25, 1, 2) (13, 3, 2)   
Casa3: (12, 2, 5)   
4:   
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Casa3: (8, 9, 5) (24, 10, 8) (18, 16, 2) (21, 17, 2) (14, 18, 8)   
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32:   
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Casa3: (18, 16, 2) (21, 17, 2) (14, 18, 8)   
33:   
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Casa2: (23, 12, 8) (1, 17, 7)   
Casa3: (18, 16, 2) (21, 17, 2) (14, 18, 8)   
34:   
Waiting clients:   
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Casa2: (1, 17, 7)   
Casa3: (21, 17, 2) (14, 18, 8)   
35:   
Waiting clients:   
Casa1: (11, 13, 6) (7, 20, 7)   
Casa2: (1, 17, 7)   
Casa3: (21, 17, 2) (14, 18, 8)   
36:   
Waiting clients:   
Casa1: (11, 13, 6) (7, 20, 7)   
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Casa3: (14, 18, 8)   
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Waiting clients:   
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38:   
Waiting clients:   
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Waiting clients:   
Casa1:   
Casa2:   
Casa3:   
45:   
Waiting clients:   
Casa1:   
Casa2:   
Casa3:   
  
  
Peak hour: 18  
Average service: 5.08  
Average waiting time: 12.373334

***6.Concluzie***

Concluzionand, aceasta tema a avut un rol important in solidificarea cunostintelor mele de java, dupa aceasta simtindu-ma mai stapan pe sine in lucrul cu threaduri. De asemenea subiectul abordat mi-a oferit ocazia de a afla mai multe despre multi-threading.

Aplicatia inca ar avea loc de imbunatatiri, putand adauga operatii de:

* Oprire prin apasarea unui buton
* Crearea unor noi criterii de prioritate a clientilor dupa un nivel de prioritate

***7.Bibliografie***

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