



University of Maribor

Faculty of Organizational Sciences

Software Quality & Testing Laboratory

dr. Robert Leskovar

Computer science and informatics

Vuk Stojkovic
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1 Theoretical explanations

1.1 Computer architecture & performances

1.2 GPS operation

1.3 Big Data

1.4 XML creation and syntax test

2 Development of OracleDB application

Estimated time consumption in hours: 3 hours

Actual time consumption in hours: 3 hours

- Create a free workspace for Oracle Apex
- In Apex, create your own table, the columns of which are related to some aspect of the company's business (eg data on employees, machines, operations performed by machines, fixed assets, salaries, orders, price lists, etc)
- Create a desktop application. Add only a report and a Report and Form to the application that refers to the table from the previous point. Enter some test data (at least 5 records).



SQL script for creating table

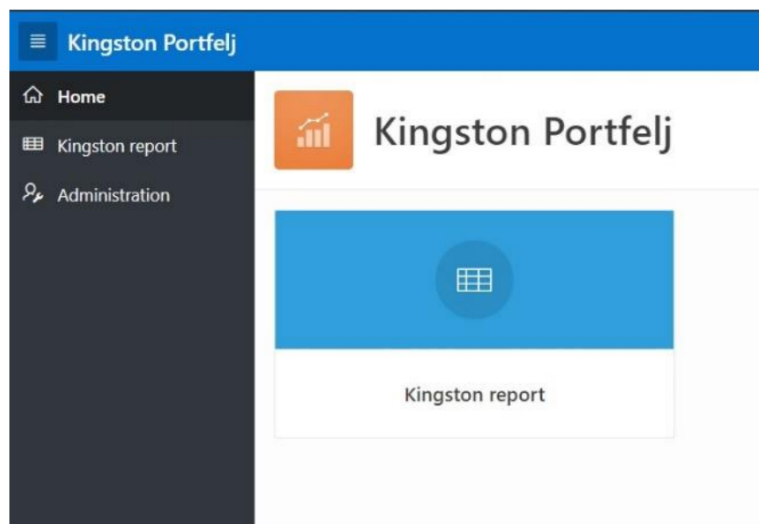
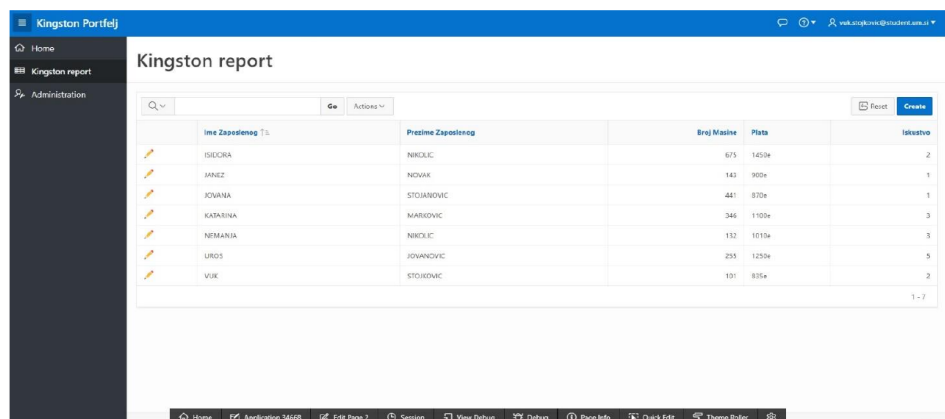


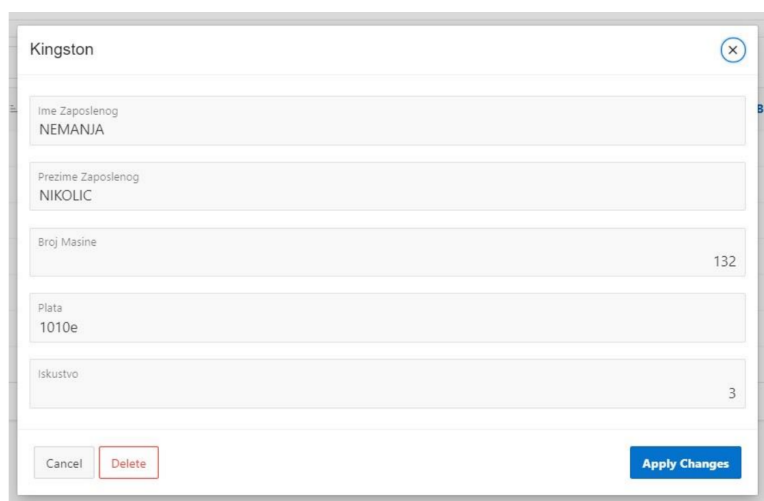
Figure 2: Database Application GUI



The screenshot shows a web application titled "Kingston Portfelj" with a sidebar menu containing "Home", "Kingston report", and "Administration". The main content area is titled "Kingston report" and displays a table of employee data. The table has columns for "Ime Zaposlenog" (Employee Name), "Prezime Zaposlenog" (Employee Surname), "Broj Masine" (Machine Number), "Plata" (Salary), and "Iskustvo" (Experience). The table contains 7 rows of data, with the last row highlighted. A "Create" button is visible in the top right corner of the table area.

Ime Zaposlenog	Prezime Zaposlenog	Broj Masine	Plata	Iskustvo
ISIDORA	NIKOLIC	675	1450e	2
IVAN	NOVIK	143	900e	1
JOVANA	STOJANOVIC	441	870e	1
KATARINA	MARJONIC	346	1100e	3
NEMANJA	NIKOLIC	132	1010e	3
URGO	JOVANOVIC	293	1250e	5
VUK	STOJANOVIC	131	835e	2

Figure 3: Database Application report



The screenshot shows a form titled "Kingston" with a close button (X) in the top right corner. The form contains five input fields with labels and values: "Ime Zaposlenog" (Employee Name) with value "NEMANJA", "Prezime Zaposlenog" (Employee Surname) with value "NIKOLIC", "Broj Masine" (Machine Number) with value "132", "Plata" (Salary) with value "1010e", and "Iskustvo" (Experience) with value "3". At the bottom of the form, there are three buttons: "Cancel", "Delete", and "Apply Changes".

Figure 4: Database Application adding new user

3 PGP Encryption

Estimated time consumption in hours: 0.5 hour

Actual time consumption in hours: 0.5 hour

Firstly I'll set up the GnuPrivacy Guard software on Kubuntu 20.04 LTS. After that, I'll generate and export pair of keys for my server, and repeat those two steps on virtual machine Windows 10, using Cleopatra software.

```
$ sudo apt-get install haveged
$ gpg --version
$ gpg --gen-key
$ gpg --list-key
```

```
(base) stepski@stepski:~/Documents/Vuk/pgp$ gpg --gen-key
gpg (GnuPG) 2.2.19; Copyright (C) 2019 Free Software Foundation, Inc.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

Note: Use "gpg --full-generate-key" for a full featured key generation dialog.

GnuPG needs to construct a user ID to identify your key.

Real name: server
Email address: server@kubuntu.com
You selected this USER-ID:
"server <server@kubuntu.com>"

Change (N)ame, (E)mail, or (O)kay/(Q)uit? 0
We need to generate a lot of random bytes. It is a good idea to perform
some other action (type on the keyboard, move the mouse, utilize the
disks) during the prime generation; this gives the random number
generator a better chance to gain enough entropy.
We need to generate a lot of random bytes. It is a good idea to perform
some other action (type on the keyboard, move the mouse, utilize the
disks) during the prime generation; this gives the random number
generator a better chance to gain enough entropy.
gpg: key 773E05BCE9F22C6B marked as ultimately trusted
gpg: revocation certificate stored as '/home/stepski/.gnupg/openpgp-revocs.d/6
074D18E4A820EE742CE263D773E05BCE9F22C6B.rev'
public and secret key created and signed.

pub   rsa3072 2021-09-25 [SC] [expires: 2023-09-25]
      6074D18E4A820EE742CE263D773E05BCE9F22C6B
uid           server <server@kubuntu.com>
sub   rsa3072 2021-09-25 [E] [expires: 2023-09-25]
```

Figure 5: Generating keys at server

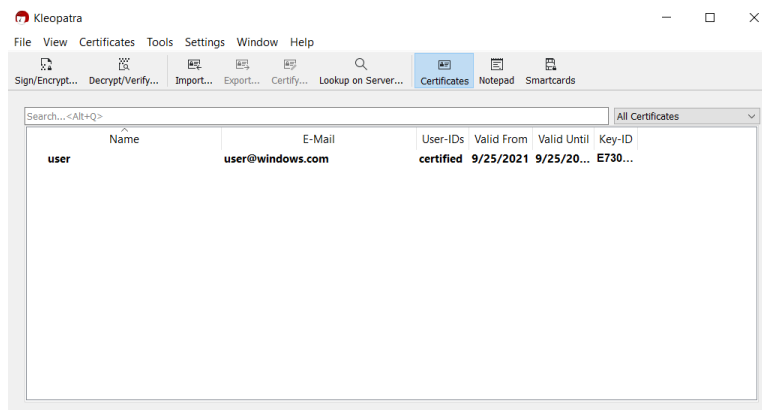


Figure 6: Generating keys for user

Next step is to import the user public key on Linux server, and use the credentials for encrypting the wanted file - in this case a simple pdf.

```
$ gpg --armor --export server@kubuntu.com > serverPublicKey.asc
$ gpg --import userPublicKey.asc
$ gpg -e -r user@windows.com --output lockedPdf.gpg --encrypt Jackknife_analysis.pdf
```

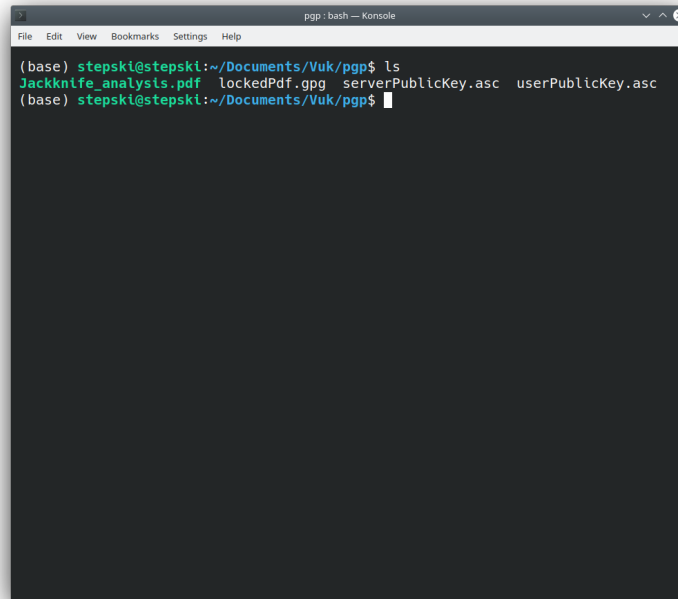


Figure 7: List of files in pgp folder on server

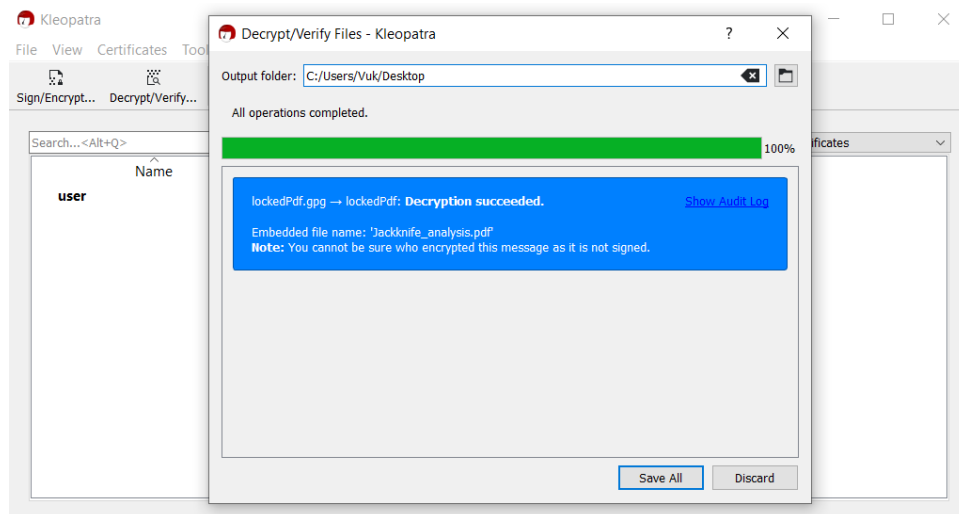


Figure 8: Decrypting file via Cleopatra

4 Microprocessor Simulator SMS32v50

Estimated time consumption in hours: 3 hour

Actual time consumption in hours: 2 hour

The task is to write an program in simulator SMSv32. The program should calculate the sum of numbers from 12 inclusive (decimal value) to 19 inclusive (decimal value) by using a loop. Use the registry of your choice to assign an initial value. The magnification step for loop control is 1. Break the loop when the condition is fulfilled. Create two versions of the program, using JNZ for one and JNS for the other.

Assembly code:

```
MOV AL, 13
MOV BL, 13
LOOP: DEC AL
ADD BL, AL
CMP AL, D
JNS LOOP
END
```

```
MOV AL, C
MOV BL, C
LOOP: INC AL
ADD BL, AL
CMP AL, 13
JNZ LOOP
END
```

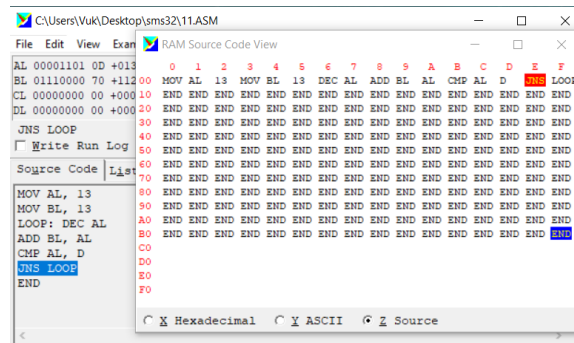


Figure 9: JNS 17B

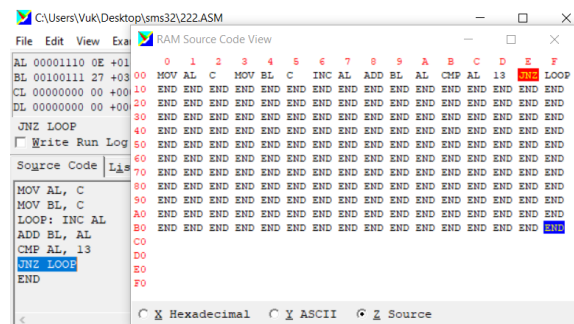


Figure 10: JNZ 17B

5 MySQL Database

Estimated time consumption in hours: 4 hour

Actual time consumption in hours: 2 hour

Create your data schema (mysql calls schemas “databases”) and 4 tables in the mysql database management system in the virtual machine. The schema named “tantalum” should support the editing specified by utf8-general_ci, and the tables the utf8 code set. You can use any interface (e.g. terminal window, phpmyadmin, mysql Workbench, etc.) to manage the database.

Table 1: the data refer to business areas in the company. Attributes are:

- sifra_poslovnega_podrocja; varchar(2),
- naziv_poslovnega_podrocja; varchar(100).

The data is comma separated and is in the same order as the following attributes:

- A: Administracija
- F: Finance in računovodstvo
- M: Marketing
- N: Nabava
- P: Proizvodnja

Table 2: data refer to the organizational structure in a company. Use the script below to create the table and data.



SQL script for creating tables

Table 3: Data refer to business processes. Use the script below to create the table and data.



SQL script for creating tables and inserting data

Write 5 queries to add to the PROCES_NOVI table. Process IDs should be between 1000 and 1004, the level can only be in the set of already existing ones. You can invent the name of the process, the local weight should be 0, and the business area should be in the set of already existing ones. Run all 5 queries at once and represent the result.

```
INSERT INTO PROCES_NOVI VALUES (1000, 'IZV', 'primer procesa izvedbenega nivoja', 0, 'A');
INSERT INTO PROCES_NOVI VALUES (1001, 'KON', 'primer procesa kontrolnega nivoja', 0, 'F');
INSERT INTO PROCES_NOVI VALUES (1002, 'OPP', 'primer procesa na nivoju operativnega planiranja',
0, 'M');
INSERT INTO PROCES_NOVI VALUES (1003, 'TAK', 'primer procesa na takticnem nivoju', 0, 'N');
INSERT INTO PROCES_NOVI VALUES (1004, 'STR', 'primer procesa na strateskem nivoju', 0, 'P');
```

Next task is to write queries for changing records in the PROCES_NOVI table:

+ Options				
sifra	nivo	naziv	lokutez	poslovno_podrocje
503	IZV	Pregled planiranih proizvodnih nalogov	3	P
504	IZV	Pregled planiranih skladiščnih nalogov	3	P
505	IZV	Pregled poročil o zalogah	3	N
506	IZV	Pregled kadrovskih poročil	3	A
1000	IZV	primer procesa izvedbenega nivoja	0	A
1001	KON	primer procesa kontrolnega nivoja	0	F
1002	OPP	primer procesa na nivoju operativnega planiranja	0	M
1003	TAK	primer procesa na takticnem nivoju	0	N
1004	STR	primer procesa na strateskem nivoju	0	P

Figure 13: Output

- process with IDs between 1000 and 1004, change the local weight to 100
- process with ID 1002 change the name to “Zombie process”
- process with ID 1004 change the business area to “A”. Present each command and the result of the execution in a report.

```
UPDATE PROCES_NOVI SET lokutez=100 WHERE sifra BETWEEN 1000 and 1004;
UPDATE PROCES_NOVI SET naziv = 'Zombi proces' WHERE sifra = 1002;
UPDATE PROCES_NOVI SET poslovno_podrocje = 'A' WHERE sifra = 1004;
```

+ Options				
sifra	nivo	naziv	lokutez	poslovno_podrocje
503	IZV	Pregled planiranih proizvodnih nalogov	3	P
504	IZV	Pregled planiranih skladiščnih nalogov	3	P
505	IZV	Pregled poročil o zalogah	3	N
506	IZV	Pregled kadrovskih poročil	3	A
1000	IZV	primer procesa izvedbenega nivoja	100	A
1001	KON	primer procesa kontrolnega nivoja	100	F
1002	OPP	Zombi proces	100	M
1003	TAK	primer procesa na takticnem nivoju	100	N
1004	STR	primer procesa na strateskem nivoju	100	A

Figure 14: Output

Now write the queries for removing the rows in table PROCES_NOVI:

- remove process with ID 1001
- remove process with ID 1000 or 1002
- remove process with ID greater than 999

```
DELETE FROM PROCES_NOVI where sifra=1001;
DELETE FROM PROCES_NOVI where sifra=1000;
DELETE FROM PROCES_NOVI where sifra=1002;
DELETE FROM PROCES_NOVI WHERE sifra>999;
```

In next few queries list following:

- all attributes of all processes
- all attributes of all processes that have a ID between 100 and 150

+ Options				
sifra	nivo	naziv	lokutez	poslovno_podrocje
503	IZV	Pregled planiranih proizvodnih nalogov	3	P
504	IZV	Pregled planiranih skladiščnih nalogov	3	P
505	IZV	Pregled poročil o zalogah	3	N
506	IZV	Pregled kadrovskih poročil	3	A

Figure 15: Output

- all attributes of all processes that have a ID between 100 and 150. Arrange the list in alphabetical order of names.
- all attributes of all processes that have a level equal to “STR” and business area “P”. Arrange the print in alphabetical order of business areas and titles.
- all attributes of all processes that have a business scope between “A” and “F”. Arrange the print in alphabetical order of business areas and titles.
- the level and number of processes of each level
- the business area and the number of processes of each business area
- the sum of all local weights
- the minimum, maximum and average value of local weights
- the sum of local weights by business areas

```

select * from PROCES_NOVI;
select * from PROCES_NOVI where sifra between 100 and 150;
select * from PROCES_NOVI where sifra between 100 and 150 order by naziv;
select * from PROCES_NOVI where nivo = 'STR' and poslovno_podrocje = 'P'
order by poslovno_podrocje, naziv;
select * from PROCES_NOVI where poslovno_podrocje between 'A' and 'F'
order by poslovno_podrocje, naziv;
select nivo, count(nivo) from PROCES_NOVI group by nivo;
select poslovno_podrocje, count(poslovno_podrocje) from PROCES_NOVI group by poslovno_podrocje;
select sum(lokutez) from PROCES_NOVI;
select min(lokutez), max(lokutez), avg(lokutez) from PROCES_NOVI;
select poslovno_podrocje, sum(lokutez) from PROCES_NOVI group by poslovno_podrocje;
select nivo, sum(lokutez) from PROCES_NOVI group by nivo;

```

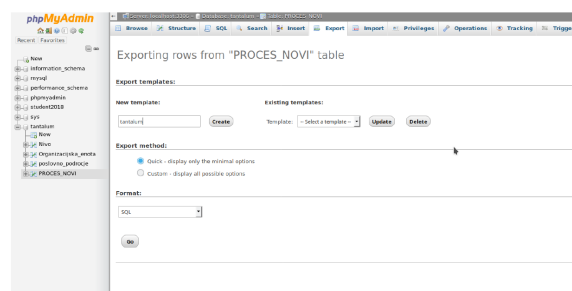


Figure 16: DBMS

6 C++ programming

Write the following program: The default constructor function enters the sum of the row index increased by 2 and the column index increased by 3 into the matrix element "v". The default constructor function, which has a parameter, should enter the sum of the row index increased by the parameter value "A" and the index of the column increased by the value of the parameter "a". The function "izpis_vse" before the value of the element of the matrix "v" printed the index of the row and column, for example: (row, column) the value of the element and the space. The main function declared object "y" with parameter 17. On object y use the function "izpis_vse" - in the main function. The main function (main) declared a vector of objects "z" of length 10 elements. All vector objects should be created with a default constructor without a parameter. Use the "izpis_vse" function on the fourth element of the "z" object.

```
#include <iostream>
using namespace std;
class tbl {
public: int v[3][3];
tbl () {
    for(int i=0; i < 3; i++)
    for(int j=0; j < 3; j++) v[i][j]= (i+2)*(j+3);};
tbl (int a) {
    for(int i=0; i < 3; i++)
    for(int j=0; j < 3; j++) v[i][j]= (i+a)+(j+a);};
void izpis_vse (){
    int i=0; int j=0;
    cout<< " \n";
    while (i < 3) {
        while (j < 3)
        {cout<<"("<<i<<" "<<j<<" "<<v[i][j]<<" "; j++;}
        j=0; i++;};};

    int main()
    {
        tbl x, y(17), z[10];
        x.izpis_vse();
        y.izpis_vse();
        z[3].izpis_vse();
        return 0;
    }
}
```

7 Java programming

The function "generiraj_nakljucno" had an integer parameter that will determine the number of iterations of the for loop in this function. Use the provided code and correct the call of this function in the main function (main) and display on the screen - write how many random numbers were generated (instead of "million" insert the calculation). Correct the for loop in the main program so that the number of iterations determines the integer parameter to which you assign a value before executing the loop. Correct the display on the screen - write down how many random numbers were generated (instead of 1000 * insert the correct calculation formula). Print the function named "izpis_rezultata". This function is private static void. It should have three parameters: the number of for loop iterations in the main program, the number of for loop iterations in the "generiraj_nakljucno" function, and the result of the calculation ((100 * (dinamicni_pi / Math.PI)) - 100). The function should display:

Pi je približno xx pri xx naključnih številih.
 Odstopanje ocenjenega Pi od pravega je xx odstotkov.
 Hvala za rože



Java code for randomPI

```

1  import static java.lang.Math.PI;
2  public class javai {
3
4
5      private static double generiraj_nakljucno(int n) {
6          int testna_mnozica = n, pozitivni = 0;
7          double x,y;
8          for (int i = 0; i < testna_mnozica; i++) {
9              x = Math.random();
10             y = Math.random();
11             pozitivni = pozitivni + (x*x + y*y < 1 ? 1 : 0);
12         }
13         return (4.0 * pozitivni / testna_mnozica);
14     }
15
16     private static void izpis_rezultata(int a, int b, double c) {
17         System.out.println("Pi je približno " + c + " pri " + a + "b + " nakljucnih stevilih.");
18         System.out.println("Odstopanje ocenjenega Pi od pravega je " + ((100*(c/Math.PI)) - 100) + " odstotkov");
19         System.out.println("\nHvala za rože");
20     }
21
22     public static void main(String[] args) {
23         double dinamicni_pi = 0., dinamicna_suma = 0.;
24         int a = 1500, b = 3333;
25         for (int i = 0; i < a, i++) {
26             // ...
27         }
28     }
29 }

```

Run | Debug

```

21  public static void main(String[] args) {
22      double dinamicni_pi = 0., dinamicna_suma = 0.;
23      int a = 1500, b = 3333;
24      for (int i = 0; i < a, i++) {
25          // ...
26      }
27  }

```

PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE

```

(base) stepski@stepski:~$ /usr/bin/env /usr/lib/jvm/java-11-openjdk-amd64/bin/java -agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:44391 -Dfile.encoding=UTF-8 -cp /tmp/vscodeswz.bd46f/jdt_ws/jdt.ls-java-project/bin javai
Pi je približno 3.1418773077387762pri 4999500 nakljucnih stevilih.
Odstopanje ocenjenega Pi od pravega je 0.00906330455546422 odstotkov

Hvala za rože
(base) stepski@stepski:~$

```

Figure 18: Output

For the second program use the provided code and change the program in Java so that it accepts only the following values: number of participants greater than 1, starting position between 0 and number of participants minus 1 and counting step greater than 1. The program must not continue until the user enters the appropriate values of variables. The program wrote the state of the count (vector circle) in a file named "potek.log".



Java code for counter

8 Web development using HTML, PHP & MYSQL

Based on the presented example, you will be able to develop your own web solution that will enable printing a list of all records in the table, viewing an individual record in the table, adding a new record to the table and, changing an existing one. The structure of the solution is shown in the diagram below:

Firstly create your own table in the virtual machine with the phpmyadmin tool. The table should have a defined key and a total of 5 attributes. Use the RII2016 schema in the database management system. Example of creating a table named files:

Using NetBeans IDE create a new project in PHP and choose any name for your project. In the Run As box, select PHP Built-in Web Server. The tool will prepare an index.php file.

Program other php files:

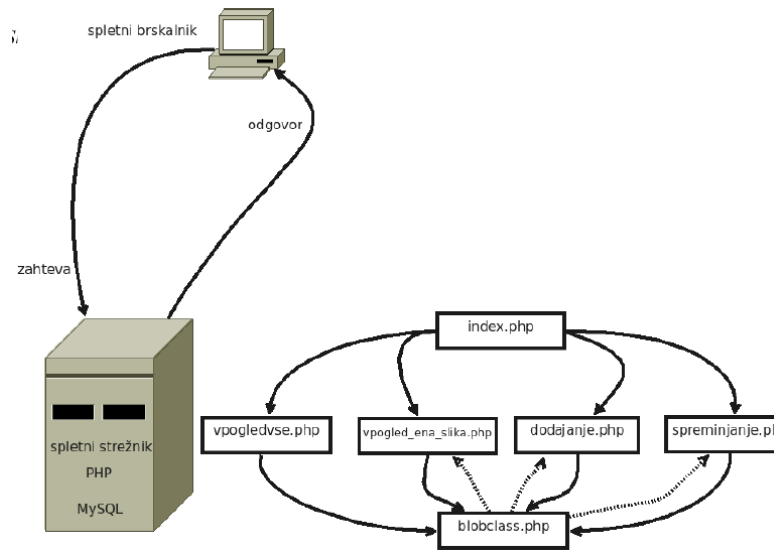


Figure 20: Output



SQL script for creating tables for web app



PHP script for creating application landing page

- `vpogledvse.php` : include the `blobclass.php` file. Declare the `BobDemo` class, and the `$ blobObj` object of this class. Call the function `$ blobObj → selectall ()`.
- `vpogled_ena_slika.php` : include the `blobclass.php` file. Declare the `BobDemo` class, and the `$ blobObj` object of this class. Download the value of the code from the web form and enter it in the variable `$ code`. This is followed by a call to the member function `$ blobObj → selectBlob ($ code)` and the result is displayed on the screen. The result is stored in the variable `$ a`, which is a field (array) with all the attributes of one record in the database - also an image in the data type blob (the limit is 2 MB).
- `dodajanje.php` : include the `blobclass.php` file. The latter declare the `BobDemo` class, and the `$ blobObj` object of this class. If no file is selected (image in jpg. Png format, etc.), print the "Error:" and the error number will be displayed. If a file is selected, this file is temporarily stored in the `/ images` subdirectory of the current directory. The file size information is displayed, followed by a call to the `$ blobObj → insertBlob` membership function, deletion of the temporary file and information that the addition was successful.
- `spreminjanje.php` : include the `blobclass.php` file. Declare the `BobDemo` class, and in this program declare the `$ blobObj` object of this class. If no file is selected (image in jpg. Png format, etc.), print the warning "Error:" and the error number will be displayed. If a file is selected, this file is temporarily stored in the `/ images` subdirectory of the current directory. Prepare variables that will allow you to change the image and call the membership function `$ blobObj → updateBlob`. This is followed by deleting the temporary file and the information that the change was successful.

- bobclass.php : prepares commands for database manipulation (SELECT, INSERT, UPDATE). First, the constructor function `__construct` is defined, followed by the functions `insertBlob`, `updateBlob`, `selectBlob` and `selectall`, which are used by the programs `vpogledvse.php`, `vpogled_ena_slika.php`, `dodajanje.php` and `spreminjanje.php`. The object constructor will provide a connection to the database, using the RII2016 schema, the student username, and the StudentFov2016 + password. Other functions prepare SQL commands (prepare - with the data we entered in the web form) and execute this command.



PHP script for creating "BobDemo"

Create new folder and name it "images". Check if the directories structure looks as this:

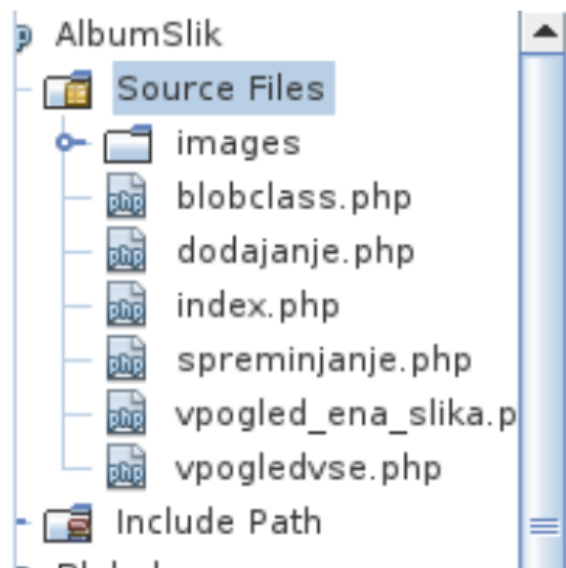


Figure 24: Project structure



PHP script for creating function "vpogledvse"



PHP script for creating function "vpogled_ena_slika"



PHP script for creating function "dodajanje"



PHP script for creating function "spreminjanje"

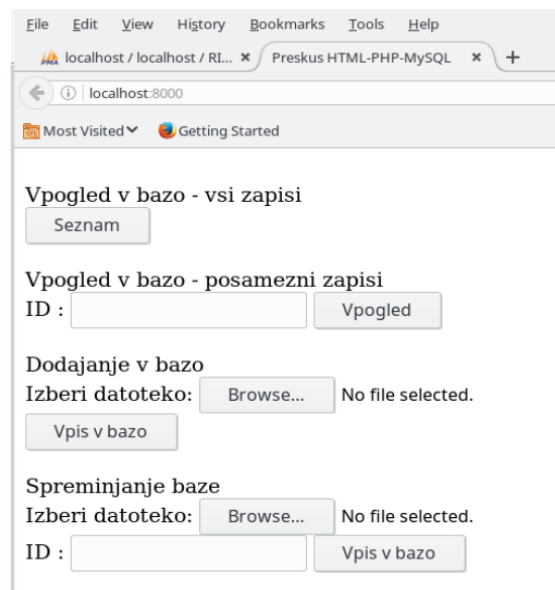


Figure 29: Web Application UI

If you click the list button, only the attributes of the table are displayed. However, no content has been added yet. Therefore, when adding, click the Browse button and select the image to upload to the database. After selecting the file, click the Register button. Upload at least 7 different images. Make sure you have successfully uploaded all the images you want by selecting Database View - Individual Records. Then replace one of the uploaded images with another - changing the database.

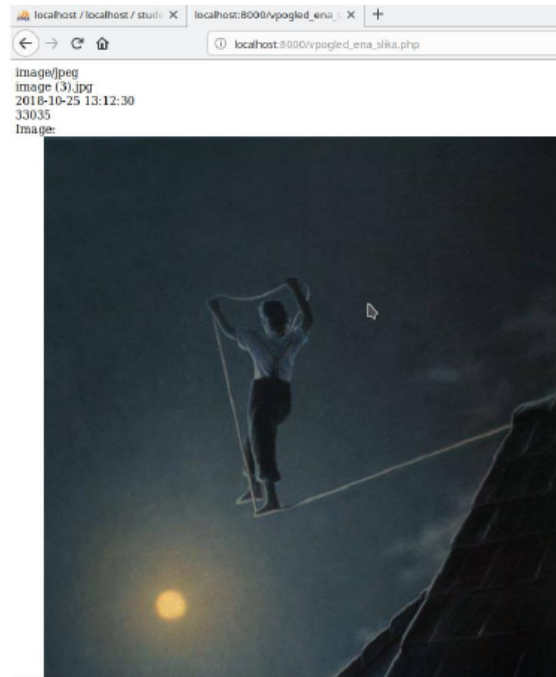


Figure 30: Web Application UI

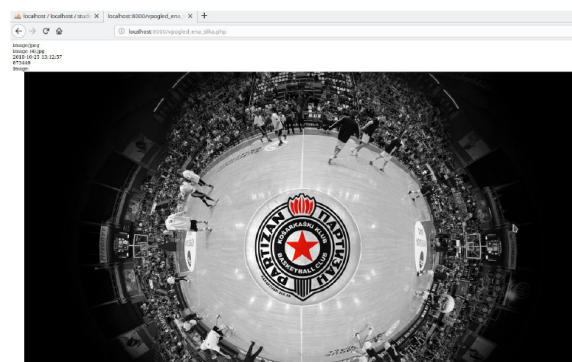


Figure 31: Adding photos to web app

Server: localhost:3306 - Database: students2018 - Table: files

Browse Structure SQL Search Insert Export Import Privileges Operations Tracking Trigger

+ Options

		id	mime	data	orig_ime	datum
<input type="checkbox"/>	Edit Copy Delete	1	image/png	[BLOB - 8.3 KiB]	Euclid.png	2018-01-02 19:23:31
<input type="checkbox"/>	Edit Copy Delete	2	image/jpeg	[BLOB - 1.8 KiB]	f2.jpg	2018-01-02 19:21:26
<input type="checkbox"/>	Edit Copy Delete	3	image/jpeg	[BLOB - 25.3 KiB]	all.5.jpg	2018-01-02 19:21:43
<input type="checkbox"/>	Edit Copy Delete	4	image/png	[BLOB - 46.4 KiB]	RStudio_Download_title_img.png	2018-01-02 19:22:02
<input type="checkbox"/>	Edit Copy Delete	13	image/jpeg	[BLOB - 48.8 KiB]	image (1).jpg	2018-10-25 13:11:20
<input type="checkbox"/>	Edit Copy Delete	14	image/jpeg	[BLOB - 31.8 KiB]	image (2).jpg	2018-10-25 13:12:15
<input type="checkbox"/>	Edit Copy Delete	15	image/jpeg	[BLOB - 32.3 KiB]	image (3).jpg	2018-10-25 13:12:30
<input type="checkbox"/>	Edit Copy Delete	16	image/jpeg	[BLOB - 853 KiB]	image (4).jpg	2018-10-25 13:12:57
<input type="checkbox"/>	Edit Copy Delete	17	image/jpeg	[BLOB - 49.6 KiB]	image (5).jpg	2018-10-25 13:13:39
<input type="checkbox"/>	Edit Copy Delete	18	image/jpeg	[BLOB - 73.9 KiB]	image (6).jpg	2018-10-25 13:13:52
<input type="checkbox"/>	Edit Copy Delete	19	image/png	[BLOB - 858.6 KiB]	image (7).png	2018-10-25 13:14:09
<input type="checkbox"/>	Edit Copy Delete	20	/home/swqlab/NetBeansProjects/AlbumSlike/images/im...		image/jpeg	2018-10-25 13:24:32
<input type="checkbox"/>	Edit Copy Delete	22	/home/swqlab/NetBeansProjects/AlbumSlike/images/im...		image/jpeg	2018-10-25 13:26:10

Check all With selected: Edit Copy Delete Export

Figure 32: Web Application database system