МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение
высшего образования
**«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»**

УТВЕРЖДАЮ
Директор
Института кибернетики ТПУ
_____ Захарова А.А.
«___»_____2015 г.

Кафедра информатики и проектирования систем

Фонд оценочных средств

ВХОДНОГО/ ТЕКУЩЕГО ОЦЕНИВАНИЯ/ ПРОМЕЖУТОЧНОЙ / ИТОГОВОЙ АТТЕСТАЦИИ

по дисциплине: «Профессиональная подготовка на английском языке (Digital Signal and Image Processing)»

Разработан в соответствии с ФГОС/ рабочей программой Хамухина А.А., утверждённой 31.08.2015

Направление подготовки: 09.04.01 Информатика и вычислительная техника

Профиль подготовки: – Информационно-коммуникационные технологии

Курс 1, Семестр 2

Распределение учебного времени

Лекции –

Лабораторные работы –.

Практические занятия 32 час.

Самостоятельная работа 76 час.

Всего: 108 час.

Дата разработки: 31.08.2015

Предисловие

1. Назначение. В соответствии с требованиями ФГОС ВПО для аттестации обучающихся на соответствие их учебных достижений поэтапным требованиям соответствующей основной образовательной программе (ООП) создаются фонды оценочных средств (ФОС) для проведения входного и текущего оценивания, промежуточной и итоговой аттестации обучающихся. ФОС является составной частью нормативно-методического обеспечения системы оценки качества освоения ООП ВПО, входит в состав ООП в целом и учебно-методических комплексов (в частности Рабочей программы) соответствующей дисциплины
2. Фонд оценочных средств текущего контроля разработан на основе рабочей программы дисциплины «Профессиональная подготовка на английском языке (Digital processing of signals and images)» в соответствии с ООП 09.04.01 Информатика и вычислительная техника
3. Проведена экспертиза, состав экспертной комиссии: доц. Рейзлин В.И. – председатель ЭК, доц. Горбунов В.М, доц. Погребной А.В. (члены ЭК)

   Экспертное заключение: ФОС соответствует требованиям ООП и ФГОС ВПО
   Председатель экспертной комиссии:
   Доцент Рейзлин В.И. _____ _____2015
4. Рассмотрено и одобрено на заседании кафедры ИПС, Протокол № __ от _____ 2015
   Зав. кафедрой Сонькин М.А. _____ _____2015
5. Разработчики:
   Доцент Хамухин А.А. _____ _____2015
6. ФОС согласован на выпускающей кафедре ИП, Протокол № __ от _____ 2015
   Зав. кафедрой Сонькин М.А. _____ _____2015
7. Фонд оценочных средств зарегистрирован
   Место регистрации
   Дата
   Ф.И.О.
8. Срок действия ФОС: до 2019 г. включительно.
9. Срок действия ФОС продлён без изменений на заседании кафедры ИПС, Протокол № _____ от «___» _____

   Зав. кафедрой Сонькин М.А. _____ _____ 2015

Паспорт оценивания результатов обучения

Направление: 09.04.01 Информатика и вычислительная техника
Дисциплина: «Профессиональная подготовка на английском языке (Digital Signal and Image Processing)»

№ п/п	Контролируемые результаты обучения по модулю (дисциплине)	Контролируемые дидактические единицы	Кол-во заданий	Вид методического оснащения	
				вид	кол-во
1	Р1 (ОК – 1,2,3,4,9,10)	З3.4.1, З8.2.1.	1	Спецификация и оценочная схема круглого стола Спецификация контрольной работы, критерии оценивания заданий	
2	Р1 (ПК – 1,2,3,4,5,14)	З3.4.1, З8.2.1.	1	Сценарий деловой игры	
3	Р1 (ПК –8,9,10, 21, 24)	З3.4.1, З8.2.1.	1	Инструкции для компьютерного тестирования, спецификация теста, критериальные баллы оценивания результатов	1
4	Р2 (ПК –8,9,10,14) (ОК –4,9,10)	У3.4.1, У8.2.1, В3.4.1, В8.2.1.	4	Требования к отчётам по практическим работам, оценочные схемы	1
5	Р2 (ОК – 1,2,3,4,9,10) (ПК – 1,2,3,4,5,9)	З3.4.1, З8.2.1, У3.4.1, У8.2.1.	1	Методические указания к реферату, оценочная шкала	1
Всего:			8		3

Банк оценочных средств

1. Перечень вопросов входного контроля знаний

Quiz 1 – True/False Questions

Please circle your answer to the following questions.

1). A single stream can be used as both an input stream and an output stream at the same time. True False

2). There can be several catch blocks in a single try/catch structure. True False

3). A method can throw more than one type of Exception. True False

4). In Java, a class can extend any number of abstract classes and an abstract class can have any number of subclasses. True False

5). Protected data members cannot be accessed by other classes in the same package. True False

6). A final method cannot be overridden. True False

7). An event listener can be registered with more than one event source to receive notifications about specific types of events. True False

8). Strings are immutable (implicitly final) in Java. True False

9). When writing objects to file using ObjectOutputStream, the objects cannot have methods. True False

10). A variable declared inside a "for" loop can be referenced outside the loop. True False

Quiz 2 Choosing Questions

1. You have been hired by a company that makes spacecraft that will travel to Mars. They want you to design a program to perform calculations to assist the spacecraft's pilots.
   Some of the quantities of interest include the distance between Earth and Mars, which can vary from 56×106 kilometers to 401×106 kilometers, and the angles that describe each planet's inclination: 0 to 7 degrees. The inclination quantities require 10 significant digits. Your program will need to handle both quantities with a single data type. You will use two variables, one for each quantity.

   Which of the following data types can handle both the distance and angular quantities and requires the lowest number of bits to store the variable? Circle the correct answer:
   a. int
   b. double
   c. float
   d. short

2. To conserve rocket fuel, the company directs its pilots to stay in Earth's orbit until Mars is in the best possible position. The program must evaluate the distance between the Earth and Mars over a 100-day period and tell the pilot which day will give the shortest distance between Earth and Mars.

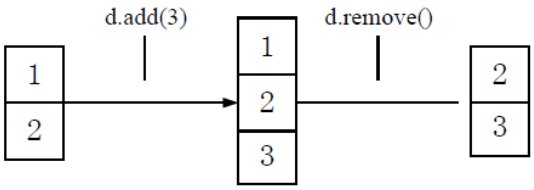
   Which type of control statement, alone, is best for computing each distance over all 100 days? Circle the correct answer:

   a. if-else
   b. for
   c. continue
   d. return

3. Which data structure d is used in the following two operations (add() and remove())?

Please circle your answer:

a. Stack
b. Queue
c. Array
d. ArrayList



4. Many operations can be performed faster on sorted than on unsorted data. For which of the following operations is this the case? We do not count the sorting operation cost. Circle the ones which can perform faster on sorted data.
   a. Finding the minimum value in the data
   b. Computing an average of values
   c. Finding the middle value (the median)
   d. Finding the range of the data (maximum – minimum).

5. During your visit to the doctor, a test is ordered to determine whether or not you have a certain disease. The test result is positive with probability 0.95 if you have the disease and 0.025 if you do not. The incidence of the disease in the general population is 1 in 10,000.

   a. If the test comes back positive what is the probability that you have the disease?
   b. If it comes back negative what is the probability that you do not have the disease?
   c. If α is the probability of a positive test result when you have the disease and $1 - \alpha$ is probability of a positive test result when you do not have the disease, what is the smallest value of α such that a positive test indicates a 0.95 probability of having the disease?

Quiz 3 – Matrices

1. Recall class Matrix, as presented in lecture:

```
public class Matrix {
private double[][] data;
public Matrix(int m, int n) {
data = new double[m][n];
}
public int getNumRows() {
return data.length;
}
public int getNumCols() {
return data[0].length;
}
public double getElement(int i, int j) {
return data[i][j];
}
// And many other methods
} // End of Matrix class
```

2. A tridiagonal matrix has nonzero elements only in the main diagonal, the first diagonal below it, and the first diagonal above it:

$$\begin{bmatrix} a_{00} & a_{01} & 0 & \cdots & \cdots & 0 \\ a_{10} & a_{11} & a_{12} & \ddots & \ddots & \vdots \\ 0 & a_{21} & a_{22} & a_{23} & \ddots & \vdots \\ \vdots & \ddots & a_{32} & a_{33} & \ddots & 0 \\ \vdots & \ddots & \ddots & \ddots & \ddots & a_{n-2,n-1} \\ 0 & \cdots & \cdots & 0 & a_{n-1,n-2} & a_{n-1,n-1} \end{bmatrix}$$

Write a method in class Matrix to check if the matrix is tridiagonal. All elements in the main diagonal and those immediately above and below it must be nonzero. All other elements must be zero. Use a tolerance of 10-15 to check if an element is zero or not. Assume the matrix is square; you do not have to check.

```
public boolean isTridiagonal() {
.......
}
```

Quiz 4 - Access

Two classes are given below. Class Student is in the package studentPKG, while class StudentTest is in the default package. Lines are labeled 1 through 28 in class Student and A through K in class StudentTest.

```
1    package studentPKG;
2
3    public class Student {
4
5         int year;
6         private String name;
7         private int studentID;
8         public static int count = 0;
9
10        public Student(String name, int studentID){
11             this.name=name;
12             this.year = 0;
13             setID(studentID);
14             ++count;
15        }
16
17        void setID(int sID){ studentID=sID; }
18
19        void setID(Student student){
20             studentID=student.studentID;
21        }
22
23        int getID(){ return studentID;}
24
25        public static void setCount(int c){
26             count = c;
27        }
28   }
```

```
A    import studentPKG.Student;
B
C    public class StudentTest {
D         public static void main(String[] args){
E              Student newStudent=new Student("", 12);
F              int snumber=newStudent.getID();
G              newStudent.name="Jason Brine";
H              int year = newStudent.year;
I              int count = Student.count;
J              Student.setCount(10000);
K    }}
```

Indicate whether the following lines compile. You may assume the logic is correct in any line that compiles. If a line does not compile, explain how you would fix the problem by modifying and/or adding code. Do not make changes to the code on page 4; write down your changes in the table below. Indicate the number(s) and/or letter(s) of the line(s) you modify. Use empty line number(s) and/letter(s) to indicate where you add code. If you add code where there is no blank line, give the line number after which to insert the code. You may not make any instance data member public.

Line	Does the line compile?	If the line does not compile, how would you fix the problem?
13	YES NO	
14	YES NO	
20	YES NO	
26	YES NO	
E	YES NO	
F	YES NO	
G	YES NO	
H	YES NO	
I	YES NO	
J	YES NO	

Quiz 5 – Streams

You are given a text file (registration.txt) that contains lines of pairs of student IDs and course names.
2381, 1.001
1812, 8.01T
1812, 1.00
2381, 18.06
9091, 1.204
1230, 1.264
9279, 8.01T
…
Each line represents a separate instance of a student registration for a particular course. The course is a String; the student ID is an int. The delimiter is a comma. You do not know the length of the file before you read all of it.
You are to write a program that:
1. reads the file,
2. counts the number of students registered in each course, and
3. prints a list of all courses with their enrollment to the console.
In addition:
1. Your program must handle any potential exceptions.
2. Your program must use an appropriate data structure to keep track of the course registrations, such as an array list, hash map or tree map.
3. You may write all or most of your program in a main() method in your class, if you wish. You may use a second class, if necessary. Give your class(es) descriptive name(s).
4. You do not need to keep track of the courses that each student takes. You only need to compute and output the number of students (enrollment) in each course.

2. Перечень вопросов текущего контроля знаний

1. Data Acquisition

1.1. Draw a block diagram to illustrate how the data was acquired. Be sure to include important parameter values.

1.2. If you examine the data, you will notice that the ECG data values have been rounded to the nearest millivolt. Is this a result of the 16-bit quantization, or was additional resolution lost after the quantization? Explain.

1.3. Consider the analog filter used in the data acquisition. Why was the signal filtered prior to sampling? Why was a cutoff frequency of 100Hz used (instead of 125 Hz)?

1.4. Assuming 16-bit quantization, what is the bit rate (in bits/sec) of the original speech? Now assume that each pitch value can be encoded in 8 bits and that each band envelope value requires 12 bits. What is the bit rate of your channel coder? Assuming 8 bits for the pitch and 12 bits for each LP coefficient and the gain value, what is the bit rate of your LP coder? How do these three bit rates compare? Be sure to state all relevant coder parameters (for example, decimation rate, model order) that affect your calculation.

2. Digital Filtering

2.1. Describe your bandpass filter. Including plots of your filter's impulse response and frequency response. Also include answers to the following questions: What were the desired specifications for the filter? How did you decide on those specifications? What filter design technique did you use? How well does your actual filter meet the desired specifications? Be sure to mention any difficulties in meeting the desired specifications as well as any tradeoffs you encountered in the design process. (Suggested length: 1–2 paragraphs.)

2.2. Describe the effect of your bandpass filter on both the clean and noisy data. Include plots of the clean and noisy data in both the time and frequency domains before and after filtering and make relevant comparisons. (Suggested length: 1–3 paragraphs.)

2.3. What are the limitations of this bandpass filtering approach? (If it were possible to implement an ideal bandpass filter with any desired specifications, would you expect to remove all of the noise?).

2.4. Select a few representative frequency bands in the filter bank and plot their frequency responses. Also plot the composite frequency response of the filter bank. Hint: Think carefully about how to determine the composite frequency response. Should you add the frequency responses of the the individual bands before or after computing their magnitude? Is the composite frequency response what you expected? Why or why not?

2.5. Compare and contrast the three filtering techniques explored in this lab. Describe the advantages and limitations of each technique. (Suggested length: one paragraph).

3. Digital Processing and Analysis

3.1. Look at the filtered signal in both the time and frequency domain and include relevant plots in your report. Compare the desired signal to the filtered output. How well did your Wiener filter perform? (Suggested length: 1 or 2 sentences)

3.2. Explain your choice of parameters (window length, window shape, and FFT length) used to analyze the spectrum. What is the effective frequency resolution (in Hz) of the spectral analysis that you performed? Be sure to state the name of the Matlab function that you used and show how you computed the effective frequency resolution.

3.3. Explain your choice of parameters of CWT and DWT used to analyze the spectrum. What is the effective frequency resolution (in Hz) of the spectral analysis that you performed? Be sure to state the name of the Matlab function that you used and show how you computed the effective frequency resolution.

3.4. What intensity value did you use for the threshold? In your lab report, include pictures of the original slice and the thresholded image.

3.5. Compare the four probing surfaces, and describe each one in terms of the characteristics listed in lectures. The functions capture region, local extrema, global extrema may be helpful. Which objective function would be preferable for use with an automated registration algorithm? How do the comparisons between objective functions change if you sample the parameter space more coarsely?

3.6. Briefly describe your smoothing filter. In your lab report, include a picture of the slice after smoothing and the new thresholded image.

4. Digital signal and image processing tools

4.1. Use the Matlab function **hist** to plot an estimate of the PDF of each source signal and include these plots in your lab writeup. Calculate the 4th moment of the signal distributions, κ, using the Matlab function **kurtosis** and record these quantities. What does the value of κ tell you about the Gaussianity2 of each signal? Relate this to your estimates of the PDFs (histograms). (Suggested length:2 or 3 sentences).

4.2. How many bins did you use? Briefly explain why you think it is a good choice and turn in the corresponding plot as well your MATLAB code.

4.3. As the classifier runs, it displays the tissue likelihoods as well as the resulting classification. What different information do the likelihoods and classification contain? Turn in your MATLAB code fragment that fills in the classification matrix.

4.4. How do your transformation estimates from the probing experiments compare to the result obtained by the automatic search?

4.5. What is the most important thing that you learned from this lab exercise? (Suggested length: one sentence)

4.6. What did you like/dislike the most about this lab exercise? (Suggested length: one sentence)

3. Перечень вопросов промежуточной аттестации (вопросы к зачёту/экзамену)

1. Data Acquisition

1.1. What is the goal of data acquisition? Explain it.
1.2. What is the result of analog signal conditioning? Explain it.
1.3. Continue and explain the next definition: “An analog-to-digital converter is a device that ....”.
1.4. Compare the continuous-time and discrete-time signals.
1.5. How make the sampling a continuous-time signal?
1.6. The Nyquist sampling theorem.
1.7. Aliasing for complex signals.
1.8. Quantization and Interpolation.

2. Digital Filtering

2.1. Explain the next expressions:
a. Digital filtering is one of the most useful type of processing for discrete-time signals.
b. Digital filters arise naturally in the modeling of physical systems, and have been used for numerical calculations at least since the invention of calculus in the seventeenth century.
c. Digital filters are used for separating signals from noise and for frequency analysis, an operation which often reveals important features in the signal.

2.2. Noise shaping. Signal to Noise Ratio (SNR).
2.3. Difference equations, FIR and IIR filters.
2.4. Basic properties of discrete-time systems, convolution.
2.5. Noise reduction.
2.6. Filter banks.

3. Digital Processing and Analysis

3.1. Discrete Fourier transform (DFT) and its properties.
3.2. Fast Fourier transform (FFT) and its properties.
3.3. Discrete-time Fourier transform (DTFT).
3.4. Types of wavelets and their properties.
3.5. Continuous and discrete wavelet transform (CWT and DWT).
3.6. The integral wavelet spectrum (IWS).
3.7. Detection of signals in noise.
3.8. Compression of digital data.
3.9. Image processing.
3.10. Modal analysis.

4. Digital signal and image processing tools

4.1. Describe implementation of the methods within the English Writing Environment (optional):
a. Mathcad;
b. Matlab;

c. Wolfram;
d. Ansys.

4.2. Choose and describe one example of problem solving:

e. identifying interturn fault rotor generators using wavelet analysis;

f. detection of hydroacoustic noise using the integral wavelet spectrum;

g. determining the type of forest fire on a noise using Fourier analysis;

h. estimation of the resonance frequencies of pipelines using modal analysis.

4. Перечень тематик отсроченного контроля

1. Участие в ФЭПО.
2. Участие в Интернет-олимпиадах.
3. Участие в конкурсах студенческих научных работ.
4. Участие в студенческих конференциях.

5. Методическое оснащение

Методические материалы, определяющие процедуру проведения контролирующих мероприятий, рекомендации по подготовке к ним, критерии, условия оценивания и др.:

1. Методические рекомендации по формированию фондов оценочных средств / Томск, ТПУ, 2012. URL: http://www.enin.tpu.ru/attachments/article/692/fos.pdf
2. Рекомендации по проектированию и использованию оценочных средств при реализации основной образовательной программы высшего профессионального образования (оопвпо) нового поколения / М., РГТУ, 2013. URL: http://www.rsuh.ru/upload/main/mu/binary/Рекомендации%20по%20проектированию%20ОС(2).doc
3. Современные технологии обучения в высшем профессиональном образовании / Беломестнова Э.Н., Древаль А.Н., Иванов Г.Ф. и др., Томск, Изд-во ТПУ, 2011. URL: http://portal.tpu.ru:7777/departments/otdel/publish/catalog/2011/departments/idno/metod/grif/idno_belomestnova_sovrem_techn_obucheniya.pdf
4. Контроль учебных достижений на основе тестовых материалов / Михайлова Н.С., Муратова Е.А., Минин М.Г., Томск, Изд-во ТПУ, 2012. URL: http://portal.tpu.ru:7777/departments/otdel/publish/catalog/2012/iip/metod_2012/avtor/IP_IDNO_MIHAILOV_I_DR_MAKET.pdf
5. MIT Course Number HST.582J / 6.555J / 16.456J “Biomedical Signal and Image Processing” URL: http://ocw.mit.edu/courses/health-sciences-and-technology/hst-582j-biomedical-signal-and-image-processing-spring-2007/index.htm

6. Примеры оценённых работ

Примеры оценённых работ пока отсутствуют, т.к. занятий на момент составления ФОС по расписанию не было.