Abschlussklausur LV 444.152 VO Medizinische Informatik – Andreas Holzinger

Vor- und Zuname →		Ausweis ok?	
Matrikelnummer →			
Studienkennzahl →			
Semesteranzahl →			
Prüfungsdatum →		←	

Welcome to the final exam of the lecture "Medical Informatics"!

This exam consists of a sum of 30 questions in 3 different question blocks. You can reach a maximum of 100 credit points, which will be used for calculation of your final grade:

Fail	Poor	Average	Good	Excellent!
Nicht genügend	Genügend	Befriedigend	Gut	Sehr gut
5	4	3	2	1
0-50	51-69	70-79	80-89	90-100

Before you start, please answer some general questions.

I feel well at the moment.
Yes, I fully agree   *No, I fully disagree* ①---------------②--------------③----------------④-----------------⑤

Medical Informatics is a difficult subject.
Yes, I fully agree   *No, I fully disagree* ①---------------②--------------③----------------④-----------------⑤

Medical Informatics is very interesting.
Yes, I fully agree   *No, I fully disagree* ①---------------②--------------③----------------④-----------------⑤

Good luck! ☺ …

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A) Yes/No decision question block

Please check the following sentences and decide if the sentence is true = YES; or false = NO; for each correct answer you will be awarded 2 credit points.

01	1-D data may consist of a string of 0-D data (e.g. integers, letters, Booleans); a typical example are sequences representing nucleotide bases and amino acids.	☐ Yes ☐ No	02/10 2 total
02	Heart rate variability (HRV) artifacts result from noise through errors in the location of the instantaneous heart beat and cause unwanted biases in HRV calculations.	☐ Yes ☐ No	02/62 2 total
03	Highly structured data contains low information entropy, i.e. H = 0 if there is no uncertainty, if everything is in order; consequently H can be useful to look for regularities in medical data.	☐ Yes ☐ No	02/53 2 total
04	The Unified Medical Language System (UMLS) is a long-term project to develop resources for information retrieval, and is to date the mostly used standardized data set in clinical practice.	☐ Yes ☐ No	03/11 2 total
05	Biomedical databases are libraries that collect data from scientific experiments and computational analyses. A typical example for such a database is OMIM (Online Mendelian Inheritance in Man).	☐ Yes ☐ No	04/32 2 total
06	Emergence is a key concept and describes the fact that a complex biological system maintains their main functions even under perturbations imposed by the environment.	☐ Yes ☐ No	05/25 2 total
07	An example for the application of supervised learning is when multiple tumor samples are clustered into groups based on overall similarity of their gene expression profiles	☐ Yes ☐ No	06/15 2 total
08	Let $U \subseteq X$ denote this risk factors and $V = X \setminus U$ the complement. The risk of immediate death can be expressed as: $p(health(t) = h|X) = p(h|V) \prod_{U \in U} p(health(t) \neq death|U, health(t-1))$	☐ Yes ☐ No	07/29 2 total
09	In a rule based expert system the certainty factor CF of an element is calculated by: CF[h] = MB[h] – MD[h]; CF is negative, if more evidence is given for a hypothesis, otherwise CF is positive.	☐ Yes ☐ No	08/15 2 total
10	RadViz is a radial visualization method, which maps a set of m-dimensional points in the two-dimensional space, thereby following Hooke's law in mechanics.	☐ Yes ☐ No	09/43 2 total

Sum of Question Block A (max. 20 points)		

B) Multiple choice question block (MCQ)

Note: The following questions are composed of two parts: the stem, which identifies the question or problem and a set of alternatives which can contain 0, 1, 2, 3 or 4 correct answers to the question, along with a number of distractors that might be plausible – but are incorrect. Please **select the correct answers** by ticking ☒ - and do not forget that every question can have 0, 1, 2, 3 or 4 correct answers. Each question will be awarded 4 points *only if everything is correct.*
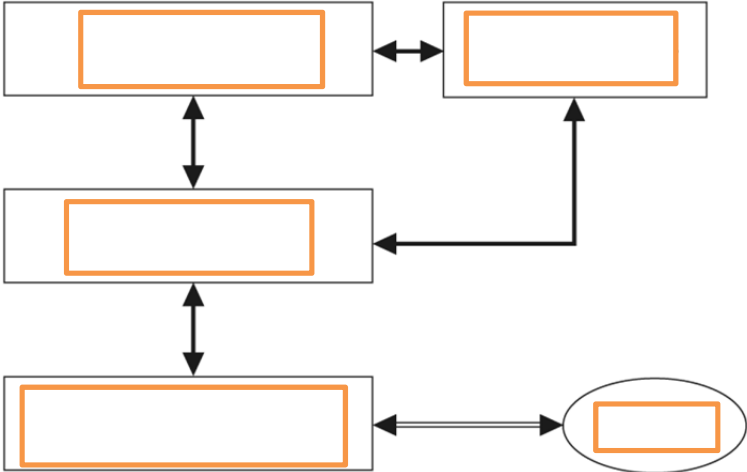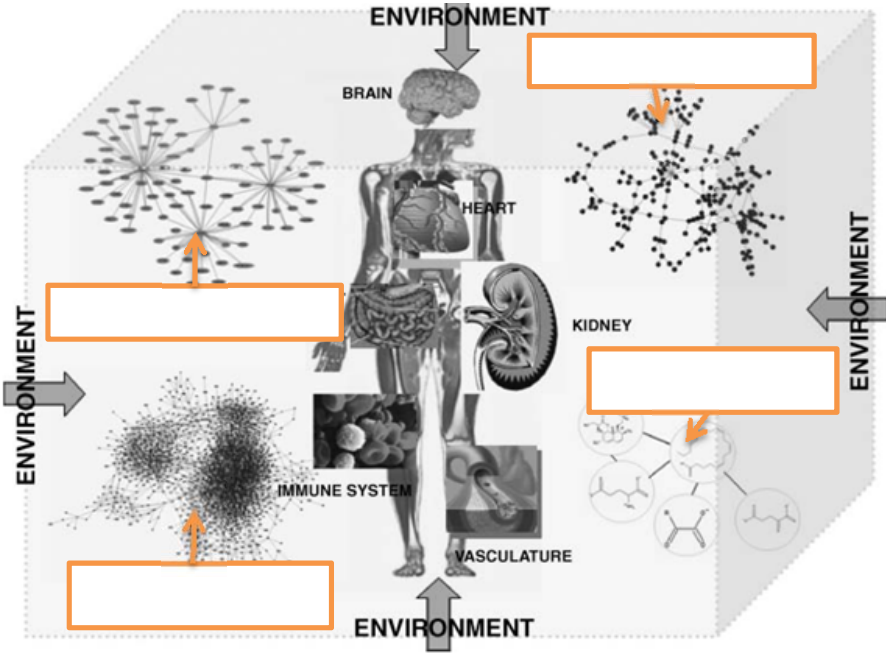
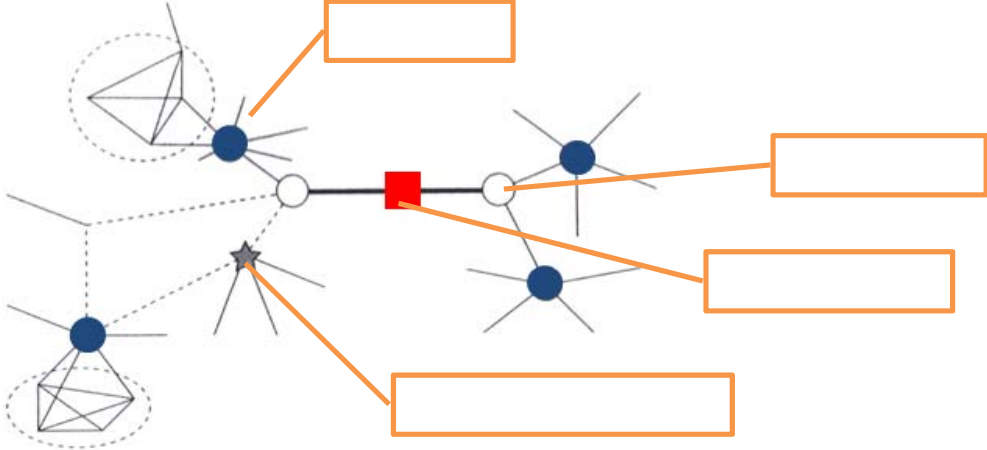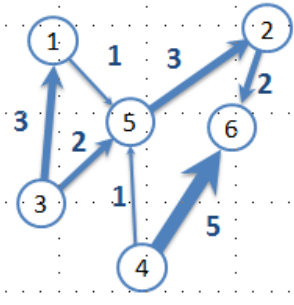| 01	In the computational space C … ❏ a) … information is data which is processed to be useful, providing answers to so-called who-what-where-when questions. ❏ b) … information is data which represents the results of a computational process, e.g. statistical analysis, assigning meaning to data. ❏ c) … knowledge is the application of both data and information, providing answers to so-called how-questions. ❏ d) … knowledge is data that represents the results of a computer-simulated cognitive process, including perception, learning, association and reasoning.	02/9 4 total
02	Molecular medicine … ❏ a) … emphasizes the importance of previous concepts and observation on patients and their organs. ❏ b) … focuses on cellular phenomena and interventions, rather than previous conceptual and observational focus on patients and their organs. ❏ c) … emphasizes cellular phenomena but does not focus on interventions. ❏ d) … aims to identify genetic errors for the cause of diseases.	01/10 4 total
03	Within the future p-Health model, so called "personalized healthcare decisions" should be made … ❏ a) … participatory, jointly together by individuals and relevant practitioners. ❏ b) … based on a mixture of individualized and population approaches. ❏ c) … constantly, based on the health information accumulated up-to-date. ❏ d) … personalized, based on individualized modeling from genomic to system levels.	01/17 4 total
04	The Quality Era of biomedical informatics is characterised by ❏ a) … focus on data acquisition, storage and accounting. ❏ b) … health care networks, telemedicine and CPOE-Systems. ❏ c) … pervasive and ubiquitous computing. ❏d) … patient empowerment and individual molecular medicine.	01/29 4 total
05	Medical data standardization refers to … ❏ a) … ensuring that information is interpreted by all end users with the same understanding. ❏ b) … supporting reusability of the data. ❏ c) … the terminologies that are used to represent the data. ❏ d) … how knowledge is represented in a health information system.	03/11 4 total

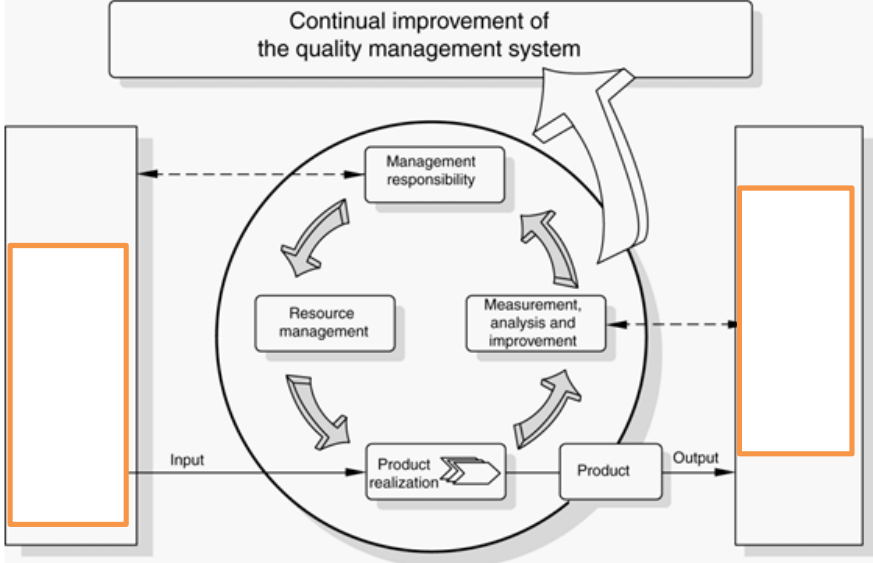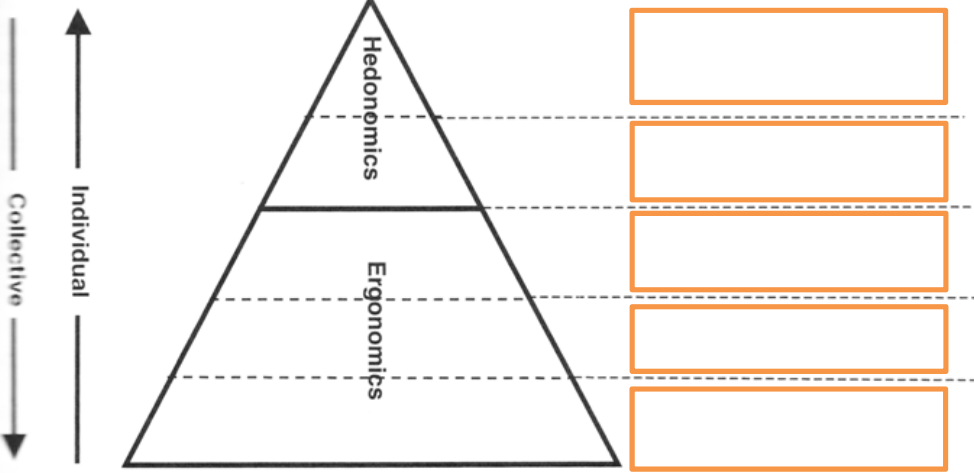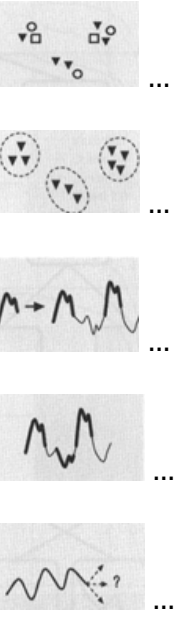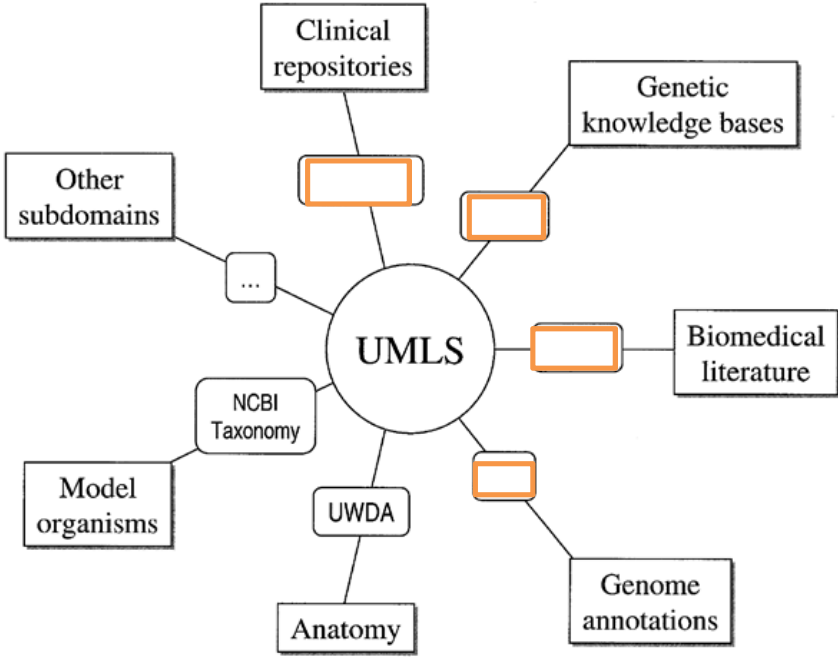| 06	Information retrieval models in the health care domain, which are following the concept of "reasoning with uncertainty" apply … ❏ … probability theories. ❏ … graph theories. ❏ … Algebra calculus. ❏ … Fuzzy set theories.	04/41 4 total
07	Threats to technical dependability in medical information systems include … ❏ a) … faults and failures. ❏ b) … fault forecasting and prevention. ❏ c) … errors and integrity. ❏ d) … confidentiality and reliability.	11/28 4 total
08	Star plot diagrams are very useful in medical data visualization, they … ❏ a) … arrange N axes on a circle in $\mathbb{R}^2$. ❏ b) … map a single point u in the plane of anchors. ❏ c) … are representing data points along a line $\ell \subset \mathbb{R}^n$. ❏ d) … are the oldest, point-based techique.	09/47 4 total
09	Support Vector Machines are an important concept in medical informatics … ❏ a) … to analyze data and recognize patterns, used for classification and regression analysis. ❏ b) … that can easily be learned in incremental fashion due to its nondeterministic algorithm. ❏ c) … having the advantage that by using kernels very complex functions can be learned. ❏ d) … generalizing principally well, but do not have a strong mathematical foundation.	6/58 4 total
10	In the framework for understanding human error in the medical domain, includes … ❏ a) … working memory constraints. ❏ b) … psychomotor variabilities. ❏ c) … novel and unanticipated events. ❏ d) … shiftwork and workgroup culture.	11/19 4 total

Sum of Question Block B (max. 40 points)

C) **Free recall block** – please follow the instruction below, at each question you will be assigned certain credit points (partial points may be given here).

01	Please describe the principle architecture of a Decision Support System:	08/19 1 each 5 total

02	Identifying networks in disease research is an important aspect of systems biology, where there is a high diversity of molecular networks within and between cells. Please identify in the following picture the networks and write the identified name of the network in the gap!	5/40 1 each 4 total

03	A graph $G(V, E)$ describes a structure which consists of nodes aka vertices V, connected by a set of pairs of distinct nodes (links), called edges $E\{a, b\}$ with $\mathbf{a}, \mathbf{b} \in V; a \neq b$. Please name the symbols in the following network example:	5/26 1 each 4 total
04	In order to represent network data in computers it is not comfortable to use sets; more practical are matrices. Please set up the *adjacency matrix* for the following directed, weighted graph:	5/27 3 total

05	ISO 13485:2003 represents the requirements for a comprehensive management system for the design and manufacture of medical devices; please complete in the following drawing the missing fields:	12/17 1 each 2 total

06	According to Maslow (1968), people have hierarchies of needs that are ordered from physiological needs to self-actualization. This theory can be used for systems design; please describe the pyramid below according to Helander & Khalid (2006):	12/44 1 each 5 total

07	Temporal analysis and temporal data mining are very important for medical informatics and especially concerned with extracting useful information from time-oriented medical data. Please describe the following temporal analysis tasks:	09/60 1 each 5 total

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08	Please complete the major components of the Unified Medical Language System (UMLS) in the following image:	03/58 1 each 4 total

09	The Medical Subject Headings (MeSH) contain two organzisation files: 1) an alphabetic list with bags of synonymous and related terms, called records, and 2) a hierarchical organization of descriptors associated to these terms. We consider that a term is a set of words (no word sequence order), that is: $t = \{w_1, \ldots, w_{|t|}\}$ where w is a word How is a bag of terms defined:	03/53 3 total
10	Please describe the General Model of Human Information Processing – fill in the gaps: 	07/10 1 each 5 total

Sum of Question Block C (max. 40 points)

That's it! Thank you for taking this exam, please fill out the final questions

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I feel well at the moment.

Yes, I fully agree   *No, I fully disagree*
①----------------②--------------③----------------④------------------⑤

Medical Informatics is a difficult subject.

Yes, I fully agree   *No, I fully disagree*
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Medical Informatics is very interesting.

Yes, I fully agree   *No, I fully disagree*
①----------------②--------------③----------------④------------------⑤

Best success for your further studies ☺ ...

Andreas Holzinger