CHALMERS
EXAMINATION / TENTAMEN

Course code/kurskod	Course name/kursnamn			
DIT 345	Fundamentals of Software Architecture			
Anonymous code Anonym kod		Examination date Tentamensdatum	Number of pages Antal blad	Grade Betyg
DIT345-0002-FX T		16-08-2023	5	3

* I confirm that I've no mobile or other similar electronic equipment available during the examination.
Jag intygar att jag inte har mobiltelefon eller annan liknande elektronisk utrustning tillgänglig under eximinationen.

Solved task Behandlade uppgifter No/nr		Points per task Poäng på uppgiften	Observe: Areas with bold contour are to completed by the teacher. Anmärkning: Rutor inom bred kontur ifylles av lärare.
1	X	21	
2	X	19	
3	X	2	
4	X	12	
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
Bonus poäng			
Total examination points Summa poäng på tentamen		54	

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DAT360 / DIT345

Fundamentals of Software Architecture

Final Exam

Time:	8:30-12:30
Teacher:	Rebekka Wohlrab, phone +TODO (coming to the exam hall at approximately 9:15 and 11:45)
Place:	Campus Lindholmen
Max Score:	100
Exam aids:	none (except for generally allowed aids, such as dictionaries)

Grading Scale: 3: 50 4: 70 5: 85

The exam consists of the following assignments:

- P1 Multiple Choice (30p)
- P2 Architectural Design Process (23p)
- P3 ATAM utilization for architecture analysis (23p)
- P4 Design requirements and design decisions (24p)

Answer in full sentences or paragraphs where a description, explanation or similar is required. Notes or bullet points are not enough. Please write legibly – if we cannot read your handwriting, we cannot give you points.

Read each assignment thoroughly before starting to work on it. Begin each assignment on a new sheet. Only write on the front of each sheet.

Label each sheet with:

- The assignment number and sub-assignment number (e.g., P1.1, P2.2, …)
- The anonymous code provided by the student office. (The exam is anonymous.)

Before handing it in: Sort your sheets in the assignment order and enumerate them as 1, 2, 3, …

Additional information

Keep in mind that we always require you to motivate your answer and to demonstrate a good understanding of the subject matter. Max points will be given for:

- Correctness.
- Soundness of your argumentation.
- General demonstration of knowledge.
- Clearness, readability and correct use of english.

Good luck!

9) The parts of a use case are
    a) Name
    b) Preconditions
    c) Secondary actors
10) A company has created a new messaging application that will be used by government official to deal with state security matters. Select the quality attributes that are of importance when developing the application:
    a) Availability
    b) Safety
    c) Security
11) What is the formula for availability? (Mean Time To Repair, Mean Time Between Failures)
    a) MTBF / (MTBF + MTTR)
    b) MTTR / (MTBF)
    c) MTTR / (MTBF + MTTR)
12) Which of the following are code quality metrics
    a) Number of files
    b) Cyclomatic complexity
    c) Number of lines of code
13) A social media company wants to create a software product that intakes a picture and enhances the light and saturation. What is the best architectural style to achieve this purpose?
    a) Pipe and filter
    b) Microservices
    c) Microkernel
14) A company wants to create a phone application for employees to keep track of attendance. What is the best architecture to achieve this purpose?
    a) Pipe and filter
    b) Microkernel
    c) Layered
15) Which of the following are methods to coordinate services in order to complete transactions?
    a) orchestration
    b) choreography
    c) mediation
16) Which of the following are SA design principles?
    a) Information hiding
    b) Cohesion
    c) Design for reusability
17) Which of the following are steps in ADD?
    a) Choose an element of the system to design
    b) Develop the software
    c) Verify interfaces of the system
18) Which of the following are phases in the ATAM?
    a) Assess market potential
    b) Tradeoffs
    c) Identify stakeholders
19) Which of the following are P2P architecture styles?
    a) mediated, pure and hybrid
    b) centralized, decentralized
    c) centralized, decentralized, mediated

P3 ATAM utilization for architecture analysis (23p)

Answer in the spaces provided below.

You are planning to use the Architecture Tradeoff Analysis Method (ATAM) for analyzing the performance of a highly anticipated and free-to-use cloud service that provides an AI chatbot (CAIC).

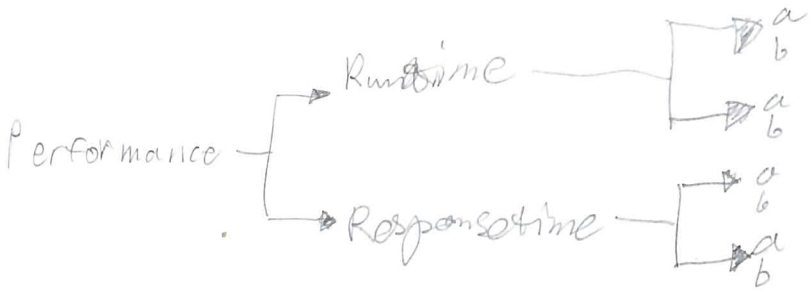
a What are the four main inputs and the four main outputs of the ATAM? (6p)

Inputs:
Architectural Design, Stakeholders
Security

Outputs:
Tradeoffs, Analysis, Performance
Revised architectural Ideas

+ 1

b Provide a Utility Tree for Performance as a Quality Attribute of the CAIC. (6p)



where are the architectural design desicions ?

c Identify three sensitivity points and correspondent tradeoffs for each sensitivity point. (6p) + 1

Sensitivity point	Tradeoff
Security ✓	
Availability ×	
Scaleability ×	

P4 Design requirements and design decisions (24p)

You have been asked to design a highly available and usability-focused server-based chat application (similar to Discord). The system should be very scalable, highly secure, and it will be accessed globally. Development cost is not a limiting factor.

Answer in at most two pages. Only write on the front side of each page.

a Identify 3 main architecture drivers and 3 Architecturally Significant Requirements (ASR) that address these drivers. (6p)

b Provide 2 design principles that relate closely to this system, as well as an antipattern for each design principle. (6p)

c Describe two styles and at least one design tactic to make each style more efficient. Explain why you made such choices. (6p)

d Provide a Concrete QAS for availability. Please use the table below to answer. (6p)

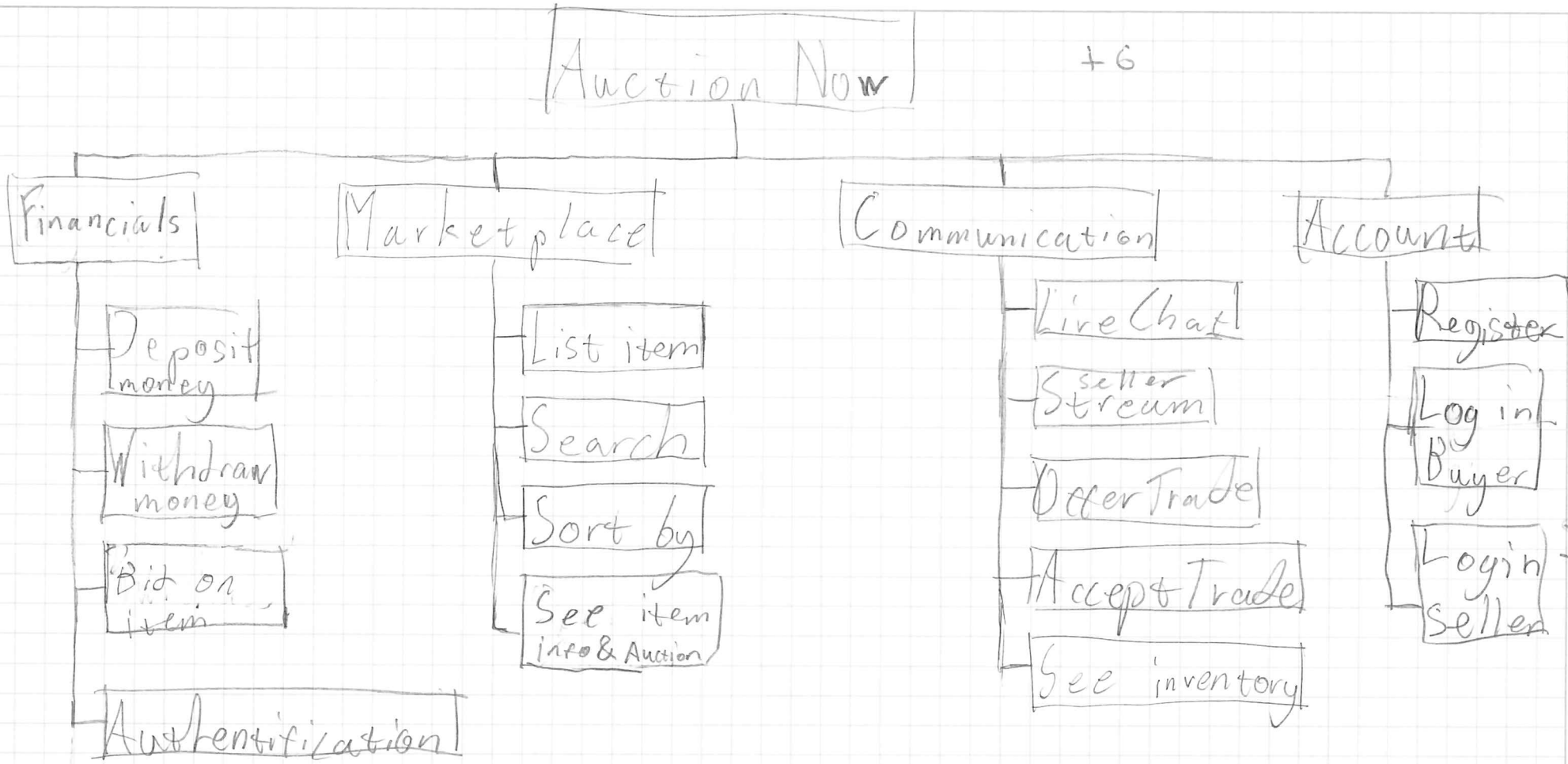
Availability Concrete QAS	
Portion of Scenario	**Possible Values**
Source	Users ✗
Stimulus	A lot of users login ✓
Artifact	Server ✓
Environment	Hardware ✗
Response	login Queue ✓
Response Measure	How many had to wait and for how long ✗

+3

CHALMERS | Anonymous code | Points for question (to be filled in by teacher) | Consecutive page no. Löpande sid nr 1

Anonym kod DIT345-0002-Fyt | Poäng på uppgiften (ifylles av lärare) | Question no. Uppgift nr P2...

1. b ~~+1~~
2. b -0,5
3. a b c d_x +3 -0,5
4. a_x b c +2 -0,5
5. b. +1
6. a +1
7. a b +2
8. a +1
9. a b +2
10. a c +2
11. a +1
12. ~~b~~ ~~-0,5~~ +1
13. a +1
14. c +1
15.
16. a b c +3
17. a +1
18. a_x b c_x +1 -1
19. c -0,5



Condition: Somewhat self reliant, All similar functionality grouped up.

CHALMERS | Anonymous code | Points for question (to be filled in by teacher) | Consecutive page no. Löpande sid nr 3

Anonym kod DIT345-0002-FyT | Poäng på uppgiften (ifylles av lärare) | Question no. Uppgift nr P2.B

b) +8p

1. Seperate functionality for e.g. sellers and buyers (modularity) ✓

2. Security should be a top priority as there are most likely customers who demand to remain anonymous. ✓

Concerns: The modularity might prove problematic once the buyer wants to sell their items and become a seller. ✓

Regulatory concern, is the system at fault in the event of a scam? ✓

c) +5

Micro services.

Having functionality be split up into modules allows the two different accounts to access some of the same functionality while still being seperated. This reduces repetition.

✓

3

+4

a) Elasticity ✓

- Needs to be scalable in regards to varying server population. ✓

Availability ✓

"Highly available" Requirement directly states should be able to use the system at all times. ✓

Private matters will be discussed and secrets shared. Security is a must to keep user trust.

b.) Scaleability

not design principles.

God-Class

antipattern not associated to anything

Accessibility

c) Publish and Subscribe. ✓ +5

Messaging means subscribing/waiting for "update" from publisher.

↑ not a design tactic

Microservices ✓

It being serverbased and worldwide means several databases for lowest ping when retrieving data.

Spreading out functionality and data is favorable. ✓