**Eastern Mediterranean University - Computer Engineering Department**

**Software Engineering Program**

**CMSE-201 Fundamentals of Software Engineering - Midterm Exam**

**Std Id\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Std Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Instructor: Alexander G. Chefranov**

**Duration: 110 Minutes May 6, 2023, 8.30**

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**Three A4 sheets of paper with *your* *handwritings* (not photocopies, printouts, etc.) may be used for your help. Electronic devices are not allowed. Passing of any material (rubbers, pencils, etc.) is not allowed.**

**There are 7 questions (totally, 100 points), 12 pages**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Tasks** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Total** |
| **points** | **9****(3,3,3)** | **9****(3,3,3)** | **9****(3,3,3)** | **9****(3,3,3)** | **30****(10, 10, 10)** | **27****(7,7,67)** | **7** | **100** |

**Good Luck!**

**Q1) 9 points** Introduction to software engineering

1. **3 points** What is the software engineering?

Software engineering is an engineering disciplined concerned with all aspects of the software production

1. **3 points** What is the difference between the software engineering and the computer engineering?

Software engineering concerns production of the software, whereas the computer engineering concerns production of the computers including hardware and software

1. **3 points** Why ethical principles are important for the software engineering?

Ethical principles are important for software engineering in particular because of the private customer information becomes known to the software engineers

Q2) **9 points** SW development model and processes

1. **3 points** What is the difference between the waterfall and V-shaped models?

The waterfall model steps are sequential, whereas in V-shaped model some steps are done in parallel

1. **3 points** What the rapid application development model is?

The rapid application development model is a software development process organization aiming acceleration of the project development by the use of such features as prototyping, cooperation with the customer, and time-boxing.

1. **3 points** What is the difference between the requirements engineering and design?

Requirements engineering aims defining of the goals of the project, whereas design aim elaborating the ways of reaching the posed goals.

Q3) **9 points** Requirements engineering

1. **3 points** Who are stakeholders?

Stakeholders are people and organizations who are interested in/affected by the system under development

1. **3 points** What the scenario is and how is it defined?

Scenario is a sequence of activities of the actors in the course of a service providing. It is defined by specifying the goal of the service, an initiating actor, participating actors, pre-condition, sequence of actions, and post-condition

1. **3 points** What for the mathematics is used in the requirements engineering?

The mathematics, if possible, is used in the requirements engineering to define the requirements formally.

Q4) **9 points** Project management

1. **3 points** How risks are classified?

Risks are classified by their impact and probability

1. **3 points** How people can be motivated for the good work?

People can be motivated for the good work by praising, giving awards, salary increase, promotion, etc., and discouraging for the bad work.

1. **3 points** How a manager can raise the team spirit?

The team spirit can be raised, e.g., by organizing common for the team events, as seminars, conferences, picnics, trips, etc.

Q5) **30 points** Project planning and scheduling

The set of the project tasks is as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Task | Effort (person-day) | Duration (day) | Dependence |
| A | 5 | 5 |  |
| B | 2 | 4 |  |
| C | 8 | 4 | A, B (M1) |
| D | 3 | 3 | A,B (M1) |
| E | 3 | 6 | C (M2) |

**Assume that the project starts on May 9, 2023, Tuesday.** The calendar is (holidays are underlined):



Taking into account actual weekends/holidays,

1. **10 points** Draw an activity network diagram with milestones and tasks, and define the earliest day of the project completion. Explain your answer.

6

3

4

4

A

B

C

D

E

9.05.23

5

16.05.23

23.05.23

31.05.23

The earliest date of the project completion is May 31, 2023 as it is the date related with the milestone “Finish”.

1. **10 points** Assuming that two software engineers, Ahmet and Alice, are available, draw a staff allocation chart (schedule) for the project. Explain your answer.

29/05/23

Ahmet

Alice

a

b

a w

b

aww

b

a

b

h

h

h

h

a

 c

 c

 c

 c

 c

c

h

h

h

h

h

h

 c

 c

Ahmet

Alice

d

e

d w

e

dww

e

e

h

h

h w

h

e

e

9/05/23

15/05/23

22/05/23

Legend: a,b,c,d,e denote tasks A,B,C,D,E, respectively; h denotes holidays and weekends

1. **10 points** Draw an activity network diagram showing tasks only. For each task of the project, calculate Early start time, Early finish time, Late start time, Late finish time, and slack time. Explain your answer.

ES

Task/duration

EF

LS

LF

0

A/5

5

0

5

0

B/4

4

1

5

5

C/4

9

5

9

5

D/3

8

12

15

9

E/6

15

9

15

Slack=LF-EF. For A,C,E, Slack=0; for D, it is 7; for B, it is 1.

In the diagram, calendar is not used, just durations are used. It is assumed that the tasks can start at time 0. Task waiting for another task(s), can start at the time instance when all the tasks waited complete. Legend is shown at the top left corner of the canvas above.

Q6) **27 points** COCOMO

Calculate the effort of the development of a software system in C++, if the project is on an early stage, and the following counts are known:

|  |  |  |
| --- | --- | --- |
| 1 | Number of simple inputs | 5\*3 |
| 2 | Number of complex inputs | 3\*6 |
| 3 | Number of average outputs | 2\*5 |
| 4 | Number of simple enquiries | 4\*3 |
| 5 | Number of simple logical files | 5\*7 |
| 6 | Number of simple external interfaces | 3\*5 |
| 7 | Number of complex external interfaces | 4\*10 |

Assume that all 14 technical complexity factors (TCF) are “Significant”. Use Basic COCOMO model. Select its mode according to the resulting project size in KLOC.

**Hints**:

To calculate unadjusted function point (UFP), multiply each count by a weight factor, according to complexity (**simple**, **average** or **complex**) of the parameter, associated with that number. The values are given in the table below



|  |  |
| --- | --- |
| **Technical Complexity Factors:****1. Data Communication****2. Distributed Data Processing****3. Performance Criteria****4. Heavily Utilized Hardware****5. High Transaction Rates****6. Online Data Entry****7. Online Updating****8. End-user Efficiency****9. Complex Computations****10. Reusability****11. Ease of Installation****12. Ease of Operation****13. Portability****14. Maintainability** | **0: No influence****1: Incidental****2: Moderate****3: Average****4: Significant****5. Essential**FP=UFP\*(0.65+0.01\*DI)DI=$\sum\_{i=1}^{14}TCF\_{i}$, where TCF is Technical Complexity Factor |

|  |  |
| --- | --- |
|  |  |
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1. 7 points Calculate UFP

UFP=sum of the products of counts and their weights=5\*3+3\*6+2\*5+4\*3+5\*7+3\*5+4\*10=15+18+10+12+35+15+40=145

1. 7 points Calculate FP

FP=UFP\*(0.65+0.01\*sum\_of\_14\_TCFs)=145\*(0.65+0.01\*14\*4)=145\*(0.65+0.56)=145\*1.21=175.45

1. 6 points Calculate size in KLOC

Size=FP\*coefficient\_for\_C++/1024=175.45\*55/1024=9649.75/1024=9.42 KLOC <=50 KLOC

Hence, Organic mode to be used

1. 7 points Calculate effort

E=a\*size^b = 2.4\*9.42^1.05 = 2.4\*10.54=25.30 person\*months

Q7) **7 points** What the software architecture is?

The software architecture is the hierarchical representation of the system as a collection of inter-related subsystems.