National University of Computer and Emerging Sciences
Chiniot-Faisalabad Campus

Fundamentals of software project management(SE4002)

Sessional-II Exam

Total Time: 50 minutes
Total Marks: 40
Total Questions: 3

Date: November 8th 2025

Course Instructor(s)
Ms.Muzzamal Asghar

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Roll No Section Student Signature

Vetted by: _____ **Signature:**_____

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Attempt all the questions.

CLO # 3: ***Apply approaches to manage and optimize the software development processes***

Q1: Project: Desktop Application [15]

A company is contracted to develop a desktop application with a fixed deadline of 16 weeks. They have a constraint of **maximum 6 persons** available at any time due to budget limitations and company policy. The project manager needs to smooth the resource usage to avoid peaks and valleys in resource allocation.

Activity Sequencing	
Activity / Task	Successor Activity
Start	A
A	B
A	C
A	D
B	E
C	F
D	G
E	H
F	H
G	H
H	Finish

Activity / Task	Activity Duration (days)	No. of Resources per day
A	2	2
B	3	3
C	6	3
D	2	2
E	5	3
F	7	2
G	3	3
H	1	2

Maximum of 6 resources available per day

Answers questions given below according to the case study given above.

Question (Calculation): Using the activity sequencing and resource requirements provided:

a) Draw the project network diagram using AOA or AON. Identify the critical path and total project duration.[5]

Question (Resource Smoothing Application): Given that the maximum available resources per day is 6:

a) Create a revised resource histogram showing the smoothed resource profile.[5]

Question 6 (Comparison): Explain the difference between resource smoothing and resource leveling in the context of this project. If resource leveling were applied instead, how might the outcome different? [5]

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CLO # 3: ***Apply approaches to manage and optimize the software development processes***

Q2: Software Development Project [10]

TechVision Inc. is developing a new mobile application for online shopping. The project manager needs to determine the project timeline and identify critical activities. The following activities have been identified with their time estimates: **Z-Table is attached**

Activity	Predecessor	Time		
		Optimistic	Most likely	Pessimistic
A	-	2	5	14
B	-	1	10	12
C	A	0	0	6
D	A	1	4	7
E	C	3	10	15
F	D	3	5	7
G	B	1	2	3
H	E,F	5	10	15
I	G	3	6	9

a. The Critical Path: A → C → E → H = 26.67 weeks. Find variance and SD.[4]

b. What is the probability that the project will be completed within 27 weeks? [3]

c. If the client needs the project completed in 19 weeks, what is the probability of meeting this deadline?[3]

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Q3: Hospital Management System Scenario [15]

MediCare Solutions has been contracted to develop a comprehensive Hospital Management System (HMS) for a multi-specialty hospital. The system will handle patient registration, appointment scheduling, electronic health records, billing, inventory management, and reporting modules. The development team needs to estimate the effort, development time, and staffing requirements using the COCOMO model.

Project Details

Project Type: Hospital Management System
Development Mode: Semi-Detached (mix of experienced and new team members, moderate constraints)
Estimated Size: 45,000 lines of code (KLOC = 45)

Questions:

Part A: Basic COCOMO

1. Calculate the effort required (in person-months) , development time and productivity using Basic COCOMO model.[5]

Part B: Intermediate COCOMO.

The cost driver analysis reveals significant complexity factors including very high product complexity rated at 1.30 due to dynamic pricing algorithms; machine learning-based recommendation engines, real-time inventory synchronization, fraud detection mechanisms, and multi-currency support. Required software reliability is very high at 1.15 because the system handles financial transactions and sensitive customer data requiring 99.9% uptime, while database size is also very high at 1.14 due to managing millions of product records, customer profiles, and transaction histories. Hardware constraints include high execution time constraints at 1.11 for processing transactions within two seconds and high main storage constraints at 1.06 due to caching and session management requirements for concurrent users. The personnel attributes show mixed capabilities with high analyst capability at 0.86 reflecting experienced business analysts, very high programmer capability at 0.70 indicating exceptional development skills, but low virtual machine experience at 1.15 revealing limited AWS cloud expertise that will require additional learning time. Project attributes include high use of modern programming practices at 0.91 through agile methodology and CI/CD implementation, and high use of software tools at 0.91 leveraging IntelliJ IDEA, Jenkins, JIRA, and automated testing frameworks.

1. Calculate the Effort Adjustment Factor (EAF), effort, development time and productivity.[5]

Project	a_i	b_i	c_i	d_i
Organic mode	3.2	1.05	2.5	0.38
Semidetached mode	3.0	1.12	2.5	0.35
Embedded mode	2.8	1.20	2.5	0.32

Part C: Analysis Questions

1. If the hospital wants to reduce development time by 20%, how would this affect the effort and team size? [3]

2. What recommendations would you make to optimize the project based on the cost drivers? [2]

Z-table

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
+0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
+0.1	.53983	.54380	.54776	.55172	.55567	.55966	.56360	.56749	.57142	.57535
+0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
+0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
+0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
+0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
+0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
+0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
+0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
+0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
+1	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
+1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
+1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
+1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91308	.91466	.91621	.91774
+1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
+1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
+1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
+1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
+1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
+1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
+2	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
+2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
+2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
+2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
+2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
+2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
+2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
+2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
+2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
+2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
+3	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
+3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
+3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
+3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
+3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
+3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
+3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
+3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
+3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
+3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997
+4	.99997	.99997	.99997	.99997	.99997	.99997	.99998	.99998	.99998	.99998