INF3708

Software Project Management

ASSESSMENT 3

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Published: 1 July 2025, 08:00 AM
Due date: 25 July 2025, 08:00 PM
Total marks: 80

This paper consists of 9 pages.

Assessment briefing:

- Good luck with this assessment.
- Copying and pasting the case and questions directly into ChatGPT and then copying the answer from ChatGPT and pasting it directly into your answer script qualifies as cheating! Without seeking recourse to special tools at my disposal that can detect a ChatGPT-formulated answer, I have developed a special talent (Sharingan) to immediately observe a ChatGPT-formulated answer or text that has been directly copied from a website.
- If you want to submit this assignment on time, start immediately. The due date will not be extended.
- Before you start with the assignment, read it through. So, read the Case, Question 1, Question 2, and Question 3.
- Submit your solution(s) by uploading a PDF file to the INF3708-25-Y site on the myUNISA website.
- The case, all names, characters, and incidents portrayed in this assessment are fictitious. No identification with actual persons (living or deceased) are intended or should be inferred.

Case

Noma Nkosi, a 20-year-old with a visual impairment, is a second-year student in the BSc Computing programme[1] at the University of South Africa (Unisa). Until the end of 2024, she participated in Project Six Spoken Breaths, led by the School of Computing. This initiative brought together researchers, academics, and students to develop an artificial intelligence (AI) tutor to assist students with visual impairments. The AI, housed in specially built air pods with a powerful microprocessor, is called TWO AUDIRE.

TWO AUDIRE facilitates interaction with coursework and assessments using automatic speech recognition and natural language processing. It integrates with the module site (including content like assessment or exam instructions), the Internet, and a virtual word processing application that converts spoken answers to text. For instance, Noma can ask TWO AUDIRE to read Assessment 2 and its questions, then capture her verbal responses in the virtual application. TWO AUDIRE can convert the completed answer sheet to a PDF and submit it via the assessment portal. Importantly, its machine-learning model is designed not to provide verbatim answers to assessment questions, ensuring students adhere to ethical and honest conduct in their academic work.

While TWO AUDIRE has improved Noma's interaction with coursework and assessments, she hopes for a more immersive experience by attending hybrid classes offered by some lecturers. One such lecturer, Dr Emil Van Der Poll, conducts face-to-face classes on Mondays and Wednesdays from 18:30 to 20:30 at the Florida Campus. These sessions are also streamed and recorded using three cameras for remote and later viewing. However, Noma faces challenges attending these sessions due to unreliable transportation.

Inspired by the success of Bolt for Women[2], Noma conceptualised Bolt Vision, a service for visually impaired students. With assistance from TWO AUDIRE, users could hail Bolt taxis for travel between home and campus. Collaborating with academics from the School of Computing, Noma drafted a business case for the project, proposing her roles as project sponsor and end-user. She also suggested naming it Project Vision, which involves integrating TWO AUDIRE into Bolt's e-hailing app. Key features of TWO AUDIRE for this project include:

1. Engaging in natural conversations to request rides exclusively from certified Bolt Vision drivers via the app.
2. Evaluating and communicating driver ratings to the user.
3. Managing payments.
4. Providing real-time updates on time and distance for pickups and drop-offs.
5. Initiating in-app calls for user-driver communication.

Bolt Vision drivers, who also serve regular customers, are trained and certified to assist visually impaired students. For such requests, drivers must guide the student from their house to the car and, upon arrival, escort them to the entrance of a campus building. However, navigating corridors and staircases inside campus buildings remains a challenge due to safety concerns like bumping into staff or other students. To

[1] Noma will complete the degree in 2035 due to her visual impairment and her involvement in projects aimed at improving the course's accessibility for students with disabilities.

[2] In an effort to combat gender-based violence, Bolt introduced an e-hailing that "enables female passengers to request rides from female drivers only" (see Times Live, 2021, para. 1)

address this, lead programmer Khushni Singh proposed equipping TWO AUDIRE with a camera and motion detection technology, named TWO EYES[3], to detect obstacles and ensure safer navigation.

At the start of this academic year, you enrolled in the Honours Information Systems programme. As part of the Software Project Management (INF4825) module requirements, you were assigned as a part-time Project Manager for Project Vision, working on the project only during hours allocated to the module.

End of case

[3] The camera technology of TWO EYES will be built into smart glasses. Since the smart glasses are not functional for visually impaired students, their purpose is solely to carry the camera technology and to enable vision-abled staff and students to identify visually impaired students by the glasses.

Question 1 **[20]**

In the business case, the project team must justify the needs driving Project Vision. You suggested consulting *Maslow's hierarchy of needs* (see Figure 1) to contextualise the motivators.

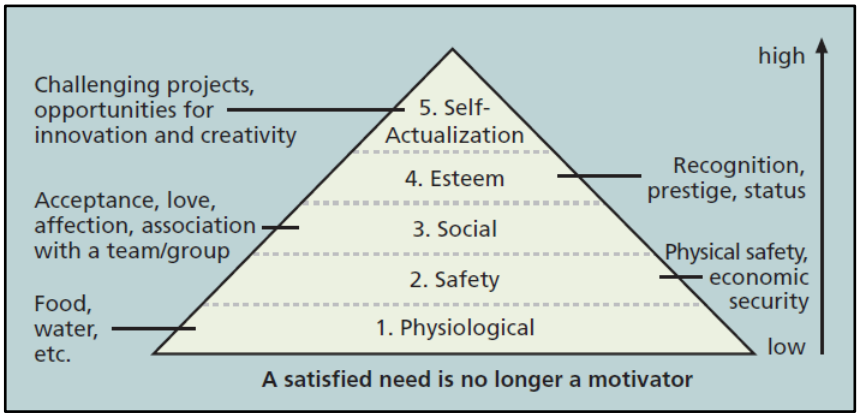

Figure 1: Maslow's hierarchy of needs (Schwalbe, 2019, p. 380)

1.1. Correlate the needs of Project Vision's end-users to Maslow's hierarchy of needs. (5 x 4)

End of Question 1

Total: 20

Question 2 **[30]**

You are assisting Noma in drafting project cost estimates for a 10-month project duration.

2.1. The suggested labour rate is R120.00/hour for each team member. You (the Project Manager) are working an average of 160 hours per month, full time. Your total hours were calculated as follow: (160/2) * 10 = 800. Why are the average working hours per month divided by 2? (2)

2.2. Calculate the work breakdown structure (WBS) level 2 total of the hardware that will be procured (see Table 1). (4)

Table 1: Project Vision cost estimate

	Units/Hrs.	Cost/Unit/Hrs	Subtotal	WBS Level 2 Totals	% of Total
1. Project management				**R326 400.00**	***Question 2.6.1***
Project Manager	800	R120.00	R96 000.00		
Project Team Members	1920	R120.00	R230 400.00		
2. Hardware				***Question 2.2***	**9%**
air pods	50	R2 500.00			
smart glasses	50	R4 000.00			
3. Software				**R1 913 000.00**	***Question 2.6.2***
Two Audire AI license	50	R500.00	R25 000.00		
Two Eyes AI license	50	R500.00	R25 000.00		
Software Development*			***Question 2.3.3***		
4. Testing (10% of total hardware and software cost)			***Question 2.4***	***Question 2.4***	***Question 2.6.3***
5. Training and support				**R110 000.00**	**3%**
Trainee cost	5	R2 000.00	R10 000.00		
Travel cost (Units in days)	50	R2 000.00	R100 000.00		
Subtotal			*R2 898 200.00*		
6. Reserves (20% of total estimate)			R579 640.00	**R579 640.00**	***Question 2.6.4***
Total project cost estimate				***Question 2.5***	

2.3. The cost estimate of Software Development in Table 1 is calculated using two approaches: a labour estimate and a function point estimate (see Table 2). The higher estimate is used.

2.3.1. In Table 2, labour cost estimation involves calculating the total cost of human resources required to complete a project. Calculate the total labour estimate. (2)

2.3.2. Function point estimation measures software size based on what the software does for the end users. For example, the external inputs functional point determines the effort required to implement the external input processes. Table 2 shows that external inputs account for the largest quantity of activities. Some involve TWO AUDIRE extracting information from the BOLT app, such as current driver location and estimated time of arrival, each treated as a separate quantity. The conversion factor quantifies the complexity in effort to complete the external input. Conversion factor typically assign values based on three complexity standards: Low complexity – 3 function points; medium complexity – 4 function points; high complexity – 6 function points. Calculate the total function point estimate. (2)

2.3.3. Based on the values that Questions 2.3.1 and 2.3.2 produced, determine the software development estimate as presented in Table 1? (2)

2.4. Based on previous projects, testing (item 4 in Table 1) is estimated as 10% of the total hardware and software cost. Calculate the testing cost. (2)

2.5. Calculate the total project cost estimate as presented in Table 1. (2)

2.6. Calculate the percentage that each cost item below is contributing to the total project cost estimate as presented in Table 1.

2.6.1. project management (1)
2.6.2. software (1)
2.6.3. testing (1)
2.6.4. reserves (1)

Table 2: TWO AUDIRE and TWO EYES development estimate (based on Jones, 2017; adapted from Schwalbe, 2019, pp. 302–303)

1. Labour Estimate	Units/Hrs.	Cost/Unit/Hr.	Subtotals
AI developers (contractors)	1920	R160,00	
Project team	1600	R120,00	
Total labour estimate			***Question 2.3.1***
2. Function Point Estimate	*Quantity*	*Conversion factor (3-6)*	*Function Points*
External inputs	30	6	180
External interface files	20	3	60
External outputs	15	3	45

External queries	15	3	45
Logical internal tables	5	3	15
Total function points			**345**
Python equivalency value[4]			200
Source lines of code (SLOC) estimate[5]			80000
• Productivity x KLSOC^Penalty (in months)[6] • 5 * 10^2			500
• Total labour hours (45 hours per function point) • 45 * total function points			15525
Cost/labour hour (R120/hour)			R120,00
Total function point estimate			***Question 2.3.2***

2.7. Examine the cash flow of Project Vision as illustrated in Table 3.

Table 3: The cash flow of Project Vision.

Year	Cash flow
0	-R3 477 840,00
1	R480 000,00
2	R650 000,00
3	R799 000,00
4	R970 000,00
5	R1 220 000,00
6	R1 470 800,00

2.7.1. Calculate the payback period to the closest approximate year, month, and day. (10)

End of Question 2
Total: 30

[4] Equivalency Value is a factor that adjusts the effort and productivity estimates in software project cost estimation to account for differences in the efficiency and complexity of various programming languages. High-level languages (e.g., Python, Java) have high productivity because they provide built-in functionalities, libraries, and simplified syntax. The Python equivalency value in Table 2 is an assumed estimate (a baseline value) derived from Project Six Spoken Breaths.

[5] SLOCK is a metric that defines how many lines of code are typically required to implement one function point. The SLOCK estimate is an assumed estimate (a baseline value) derived from Project Six Spoken Breaths.

[6] Productivity represents the rate at which work is completed, typically expressed as the number of function points delivered per unit of time (e.g., per month or hour). Higher productivity implies greater efficiency. Key level of software complexity (KLSOC) is a factor representing the overall complexity of the software system (e.g., complexity of business rules). Penalties are typically measured in time delay, e.g., delay in implementing because of delays in decision-making, skill shortages, changing requirements, project risks, or other inefficacies.

Question 3 **[30]**

The activities illustrated in Table 4 represents the functional and technical requirements for adapting TWO AUDIRE to Bolt Vision and integrating TWO EYES.

Table 4. The activity label description estimated duration and predecessor that inform design and machine learning process of Project Vision.

Activity Label	Activity Description	Estimated Duration (weeks)	Predecessor
A: Requirements Analysis	Identify the functional and technical requirements for adapting TWO AUDIRE to Bolt Vision and integrating TWO EYES.	2	None
B: API Development	Develop APIs for TWO AUDIRE to interact with Bolt's e-hailing app (e.g., ride requests, payment facilitation).	3	A
C: Natural Conversation Update	Enhance TWO AUDIRE's natural language processing to handle ride requests and driver communication.	2	B
D: Driver Performance Module	Build and integrate a module for evaluating and communicating driver ratings to the user.	2	B
E: Motion Detection Algorithm	Develop the motion detection and obstacle recognition algorithm for TWO EYES to identify obstacles and movement paths.	4	A
F: Camera Integration	Implement and test the camera hardware integration with TWO AUDIRE for TWO EYES.	3	E
G: Corridor Navigation Feature	Add logic and controls for TWO AUDIRE to guide users safely through corridors using TWO EYES' camera input.	3	F
H: User Interface Updates	Update the TWO AUDIRE interface to include new features like live ride tracking, driver updates, and navigation feedback.	2	C, D, G
I: Testing and Validation	Conduct end-to-end testing of TWO AUDIRE and TWO EYES functionality with Bolt Vision integration.	4	H
J: Deployment	Deploy the updated TWO AUDIRE and TWO EYES system with Bolt Vision in a production environment.	1	I

3.1. Adopt the legend system illustrated in Figure 2 to create an activity-on-node (AoN) diagram of the activities listed in Table 4. Add start and end nodes. (12 x 2)

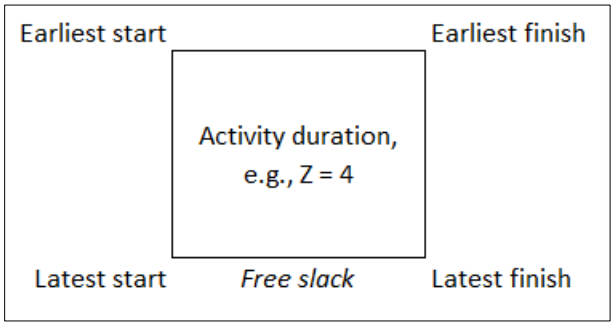

Figure 2: the activity-on-node system

3.2. Identify the activities with slack and the number of weeks slack. (4)

3.3. Identify the critical path. (2)

End of Question 3
Total: 30
End of Assessment 3
Total: 80

Bibliography

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