UNIVERSITY OF KWAZULU-NATAL
Discipline of Electrical, Electronic and Computer Engineering
(Howard College Campus)

Examinations: **November 2025**

ENEL3SF H2 : Software Engineering II

DURATION :2 HOURS MARKS : 100

Examiners:

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Instructions:

1. Answer ALL 5 questions.
2. Start each question on a new page, and number all your answers clearly.
3. Calculators may be used.
4. Ensure you have 6 pages, including this one.
5. **This paper may not be removed from the exam hall.**

Question 1: *Software Project Management and Planning* **[16 marks]**

(a) A good project management team includes [2]

(A) Technical experts
(B) Management experts
(C) domain experts
(D) all of the above
(E) none of the above

(b) Software project management includes [2]

(A) staffing
(B) training
(C) estimation
(D) all of the above
(E) none of the above

(c) An effective software project management provides [2]

(A) effective test plans
(B) effective code reviews
(C) effective budget and resource planning
(D) all of the above
(E) none of the above

(d) Cost difference in product developed by the same team depends on [2]

(A) duration of development
(B) complexity of development
(C) technology of development
(D) all of the above
(E) none of the above

(e) You are the manager of a new project, which entails developing a large program to the control the equipments of the new mining company. You have to choose to hire from two pools of developers - one having highly capable developers having very little experience in the programming being used and another having less capable developers with a lot of experience with the programming language. What is the impact of hiring all developers from the same group. What are the risks management activities? is it possible to prioritise the risks? [8]

Question 2: *Software Metrics and Quality Assurance* **[22 marks]**

(a) Explain the relationship between software quality, software standards, and software metrics. Illustrate how they jointly contribute to quality management. [6]

(b) Which of the following best describes the main purpose of software metrics in software engineering? [2]

(A) To quantitatively measure software attributes for assessment and improvement

(B) To determine the programming language used in software development

(C) To ensure all software follows the same design structure

(D) To replace qualitative software testing methods

(C) To identify the operating system on which the software runs

(c) Software Quality Assurance (SQA) primarily focuses on: [2]

(A) Detecting defects after the software is deployed

(B) Ensuring adherence to defined processes and standards during development

(C) Measuring hardware performance

(D) Writing test cases for all functions

(E) Evaluating user satisfaction only after delivery

(d) Which of the following metrics is commonly used to measure software reliability? [2]

(A) Lines of Code (LOC)

(B) Cyclomatic Complexity

(C) Mean Time Between Failures (MTBF)

(D) Function Points

(E) Coupling and Cohesion

(e) Which of the following is a product metric? [2]

(A) Mean time to failure (MTTF)

(B) Effort per function point

(C) Schedule variance

(D) Defect density per thousand lines of code (KLOC)

(E) Staff turnover rate

(f) Discuss the challenges of managing people in software projects and explain how team motivation and communication impact project success. [8]

Question 3: *Project Scheduling* **[25 marks]**

(a) Explain the significance of project scheduling and resource allocation in software project planning. [5]

(b) Consider the PERT diagram of a software development project schedule given in Figure 1. The number corresponding to each edge of the graph indicates the number of weeks required to complete the task represented by that edge. For instance, it takes 6 weeks to complete the task that starts from **G** and ends at **I**.

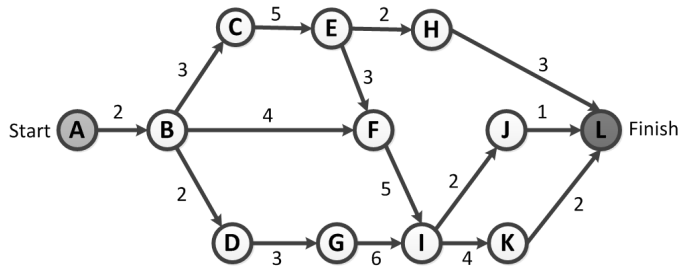


Figure 1: PERT diagram

(b.1) What is the earliest completion time for the project? [2]

(b.2) What is the Slack Time of each task and each event? What is the critical path of the project? [16]

(b.3) What would happen to the project if the task starting from **G** and ending at **I** was delayed by 4 weeks? [2]

Question 4: *Software Implementation and Testing* **[22 marks]**

(a) Give a pseudo-code to solve the equation $ae^{2x} + be^x + c = 0$, where x is the unknown and a, b and c are parameters; assume that you can reuse the module `Expo(r,q)` to solve the equation $e^{rx} = q$. The function $Expo(r, q)$ receives as input the real numbers r and q, and returns the solution x of the equation $e^{rx} = q$, if it exists and the message "*No solution*" otherwise. You must provide discussions on the different choices made. [10]

(b) Consider the following code fragment

```
double dx = 0.1;
   double z[40];
    int N = 40,i;
       for(i=0; i <=N; i++)
    {z[i] = sin(x)/(x-2.5); x = x+dx;}
```

Identify the error in this code. Which type of coverage criterion should be exercised to detect it? [2]

(c) The source code, **Kthdigit**, in Figure 2 receives as arguments two integers, n and k, and returns the k^{th} digit (from the right) of the positive integer n.

```
1. int Kthdigit(int n, int k)
2. {
3.  int i = 0, kdigit=-1,n1 = n;
4.  while(n>9)
5.   {
6.    i++;
7.    if(i ==k)
8.   {
10.    kdigit = n%10;
11.    break;
12.  }
13.   else  n  = n/10;
14. }
15. if((n==n1) && (k==1)&& (i==0) )
16    kdigit=n;
17. return kdigit;
18.}
```

Figure 2: Code to extract the k^{th} digit of a given number n

(c.1) Draw a flowchart (control-flow graph) of the code given in figure 2. [6]

(c.2) Compute its cyclomatic complexity and list one basis path test set. [2]

(c.3) Propose test cases that achieve blanch coverage. [2]

Question 5: ***Embedded Systems*** **[15 marks]**

(a) Give a definition of *embedded system* and list two examples of embedded applications. [2]

(b) With the help of a simple diagram, explain the layered architectural pattern commonly used in embedded systems. [5]

(c) Discuss the role of timing analysis in real-time embedded systems, and explain what could happen if a task misses its deadline. [5]

(d) What is the key purpose of a real-time operating system (RTOS) and cite three of its key functions. [3]
