

Government Engineering College, Ajmer (Rajasthan)

Semester – 8th

Branch – CS

Subject – RTS (Real Time System)

Date – 15/2/2018

Mid Term – 1

Max Marks – 10

Duration – 1 Hour

Q1. Differentiate Real-Time Systems Vs General Purpose Systems. Why Real-Time System performance is measured on timing constraints. (1.5+1.5)

Q2. Short note on:

- a) Classify Real-Time Task based on Activity Criterion and Criticality Criterion. (1)
- b) Classification of Real-Time System (2)
- c) Predictability Vs Adaptability (2)

Q3. In Real-Time System, we assume that system manages only periodic task, If phase of the periodic task is 12, period is 7, relative deadline is 7 and its execution time is 5. Find the release time and absolute deadline of 50th instance of periodic task. (1+1)

Ans 1. Real-Time Systems Vs General Purpose Systems:

- Real-time systems define a paradigm of computing that is very different from traditional or general-purpose computer systems.
- The dynamics of the underlying physical processes place explicit timing constraints on the individual task, which must be met in order to ensure the correctness and safety of real-time systems. Hence, “time” is treated as most precious resource to be managed in real-time systems.
- The operating environment of real-time systems is frequently more hostile than general-purpose computer systems.
- The performance of real-time systems needs to be much more carefully modeled. Unlike in non-real-time systems where average case performance is often important. The performance of real-time systems under worst-case conditions is a fundamental criterion for majority of real-time application.

Real-Time System performance is measured on timing constraints because:

- “Time” is the most precious resource to be managed.
- Tasks arrive endlessly in the computer system and initiate requests for their execution.
- Every request carries a timing constraint for its completion called the “deadline”.
- The real-time task must be assigned and scheduled to be completed before its deadline.
- The correctness of computation not only depends on the logical correctness but also on the time at which results are produced.
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Ans 2. A) Activity Criterion: It defines how a task occurs i.e. periodically, aperiodically or sporadically

- *periodic,*
- *aperiodic*
- *sporadic tasks.*

Criticality Criterion: It defines the strictness of deadline:

- Hard
- Firm
- soft

b) Hard Real-Time Systems:

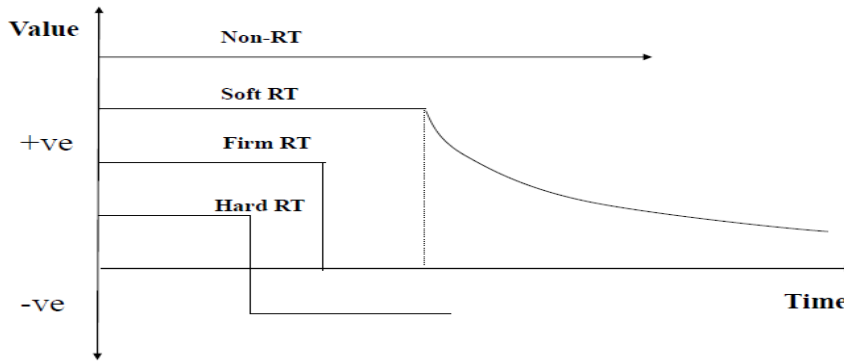
- Have stringent timing requirements
- Timing constraint of safety critical tasks must be satisfied under all circumstances
- The failure of computer to meet certain task execution deadline can result in serious consequences.

Soft Real-Time Systems:

- Have deadlines but not so stringent.
- Failure to meet soft deadlines will not result in hazardous situation.
- The utility of results produced by a task with a soft deadline decreases over time after the deadline expires.

Firm Real-Time Systems:

- Consequences of not meeting the deadline are not very serious.
- The utility of results produced by a task ceases to be useful as soon as the deadline expires.



C) Predictability:

- Predictability is defined as the ability of the controlling system to determine a task's completion time with certainty and ensuring that all hard deadlines will be met, taking system state and task's resource need into account.
- The importance of this requirement of a real-time system can be demonstrated by considering the example of an air-defense system monitoring the sky for incoming enemy missiles. The nature of this application demands that the incoming enemy missile must be detected and destroyed within a predefined deadline without failing.
- To ensure this, the behavior of the controlling real-time computing system must be predictable. That is, it should be possible to show at design time that the timing constraints of the application will be met as long as certain system assumptions are satisfied.
- Depending on application, two type of guarantees are provided to ensure the predictability of the system
 - Static Guarantee
 - Dynamic Guarantee

• Adaptability:

- If a system is adaptive, one does not have to redefine the system or recomputed resource and task allocation for every small change.
- The adaptability reduces development and maintenance costs and allows system to expand without redefining the whole system.
- A real time system should be adaptive to change in system state including overloads and failures, system configuration, input specification, and task specifications.

Ans 3. Periodic task:

Phase (Φ_i): 12,

Period (T_i): 7,

Relative Deadline (D_i): 7,

Execution Time (C_i): 5

Release Time ($r_{i,n}$) of n^{th} instance of periodic task:

$$r_{i,n} = \Phi_i + (n-1) * T_i$$

$$\text{So } r_{i,50} = 12 + (50-1) * 7$$

$$r_{i,50} = 355$$

Absolute Deadline ($d_{i,n}$) of n^{th} instance of periodic task:

$$d_{i,n} = (\Phi_i + n * D_i) \text{ or } d_{i,n} = (r_{i,n} + D_i)$$

$$d_{i,50} = (12+50*7) \text{ or } d_{i,50} = (355+7)$$

$$d_{i,50} = 362$$