CHL771/CLL781 Minor - I (closed book and notes)

Q1. Write a flow shop scheduling model for minimizing makespan (*MS*) for a process with 10 sequential machines ($m = 1$ to 10) to produce 15 items ($i = 1$ to 15), given the item and machine dependent processing times (PT_{im}). Once started, jobs must be carried out to completion, but the items may wait between the machines. Every machine only processes one batch of an item at a time. The demand for each item is uncertain and is given as number of batches in a range: D_i^{min} to D_i^{max}. [10 M]

Q2. Draw state-task-network (STN) diagram for a process shown in Fig. 1. The process uses two raw materials (Feed 1 and Feed 2) produces three intermediates (Int1, Int2, Int3) and two products (prod1, prod2) as per the recipe shown in Fig. 1. There are two types of reactors available (type A and type B) with different number of corresponding units: two reactors of type A (RA1 and RA2) but only one reactor of type B (RB1). Reactions R1 and R2 require a type A reactor whereas reactions R3 and R4 require a type B reactor. Furthermore, reactions R1 and R3 require heat, provided by steam (HS) available in limited amounts in plant, whereas reactions R2 and R4 are exothermic and require cooling water (CW), also available in limited amounts. Assume that the scheduling model does not have equipment identity in the nomenclature and uses two-index decision variables, for e.g. $w(i,t)$, $b(i,t)$ etc. [8 M]
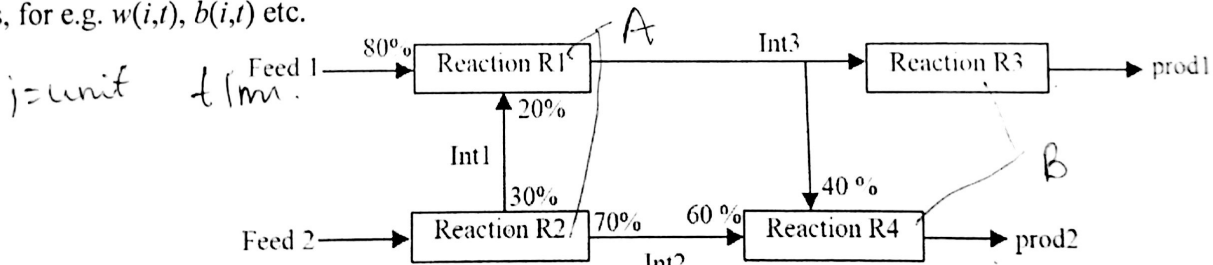

Fig. 1. Process flow sheet for question 2

Q3. Explain the procedure for choosing the number of discrete time intervals in a scheduling model [2 M]