



Embedded electronic engineering A: Hardware-software codesign seminar

Game theoretic scheduling

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Game theory concepts

- Game = strategic situation + game rules
- Player moves = strategies
- Objective of strategies = “payoffs”



Game theory concepts

Games can be of two types:

- Cooperative: joint strategy
- Non-cooperative: individual strategies



Game theory example: Prisoner's Dilemma

	Prisoner A cooperates	Prisoner A defects
Prisoner B cooperates	1 month for both	A: free, B: 10 yrs
Prisoner B defects	A: 10 yrs, B: free	5 years for both



HLS algorithm

```
diffeq {  
  read(x; y; u; dx; a; n);  
  do {  
    x1 = x + dx;  
    u1 = u - (3*u*x*dx) - (3*y*dx);  
    y1 = y + u*dx;  
    n1 = n + 1  
    c = x1 < a  
    x = x1;  
    u = u1;  
    y = y1;  
    n = n1;  
  } while(c)  
  write(y, n)  
}
```

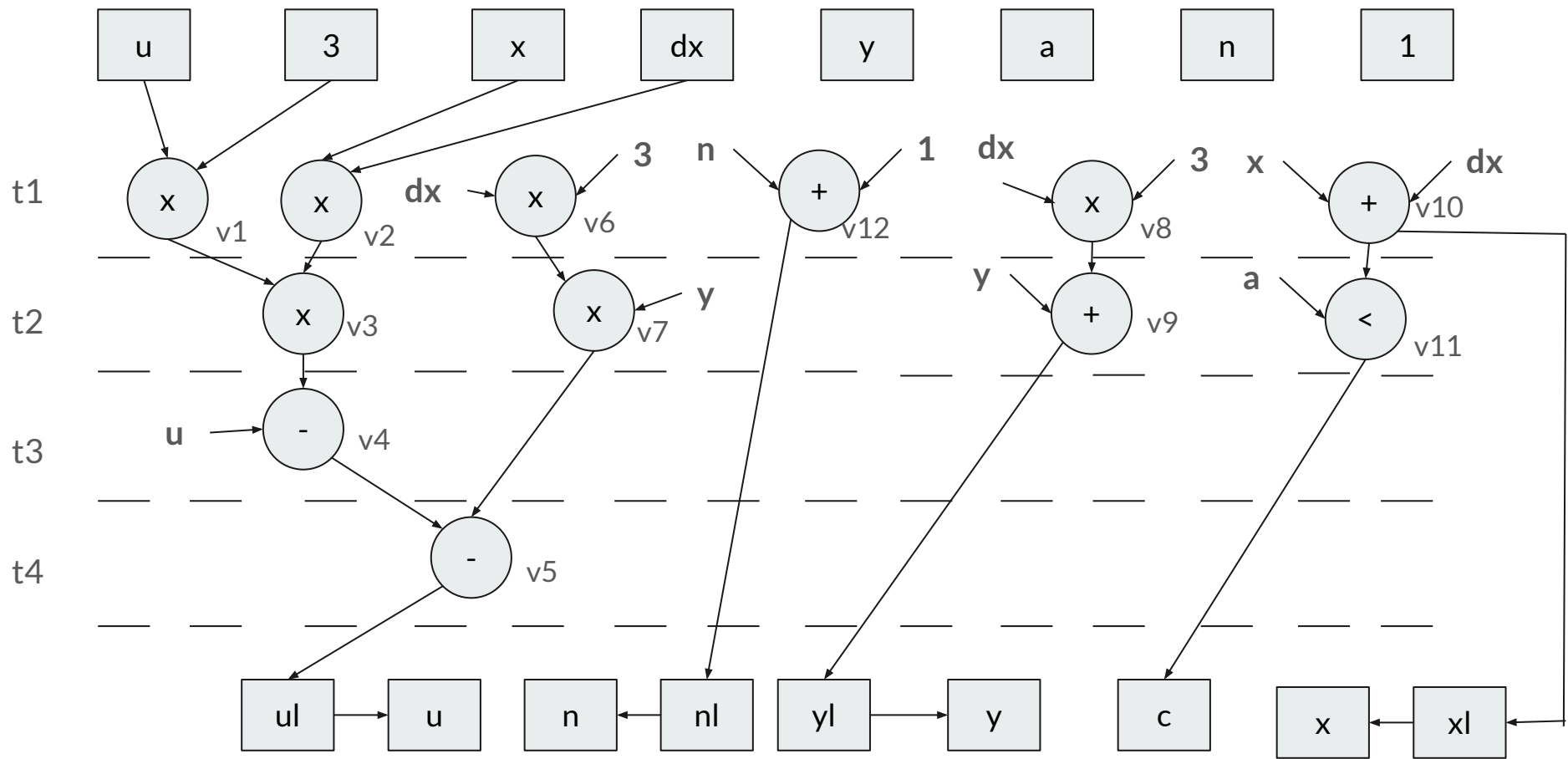


Figure 1: ASAP scheduling

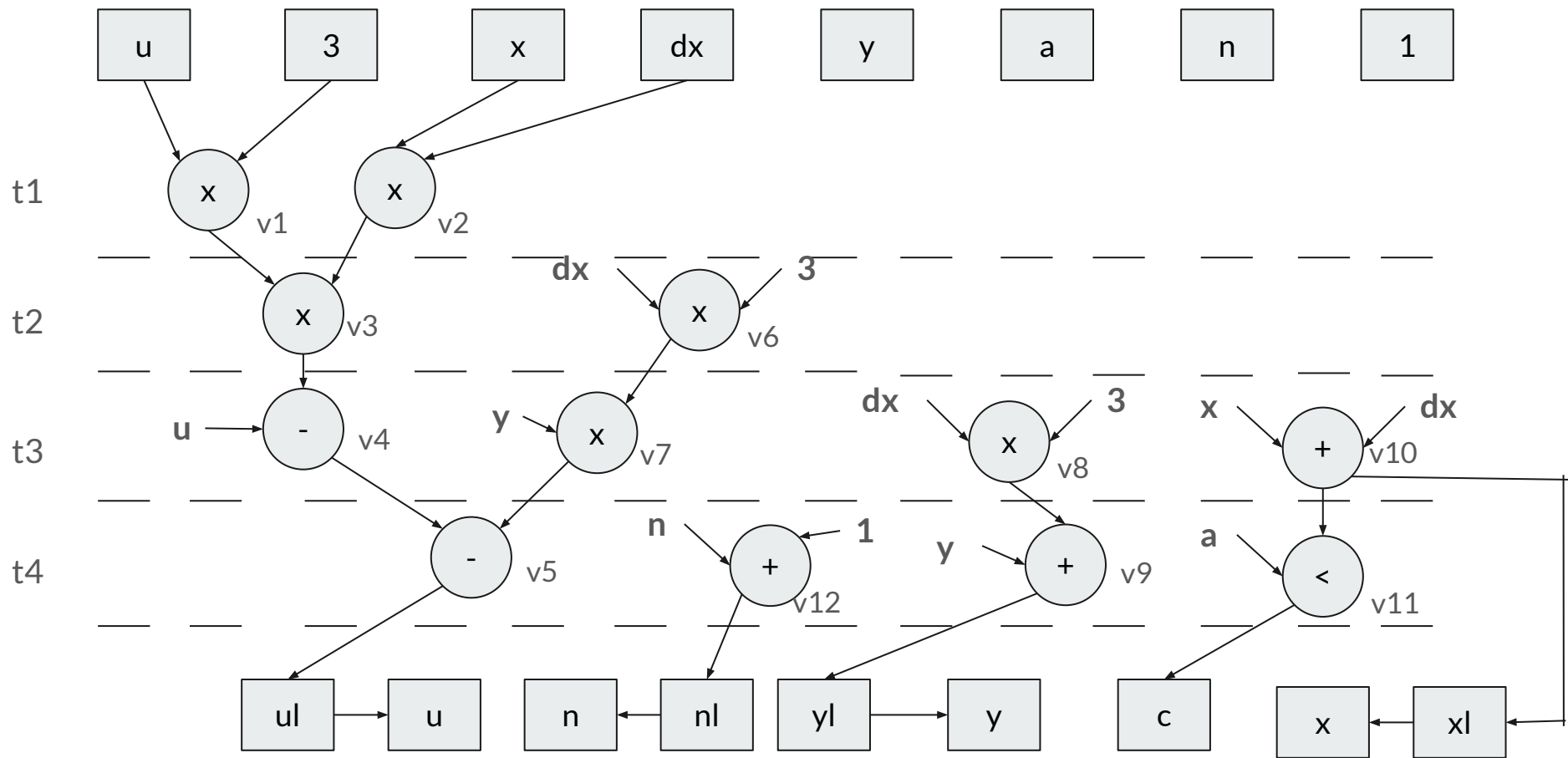


Figure 2: ALAP scheduling



Mobilities (≥ 1)

- $V_6 = 1$
- $V_7 = 1$
- $V_8 = 2$
- $V_9 = 2$
- $V_{10} = 2$
- $V_{11} = 2$
- $V_{12} = 3$



Game theoretic scheduling: cooperative

Game Theory	HLS Scheduling
Players	Each clock cycle
Payload	Each operation
Strategy	Operations per clock cycle

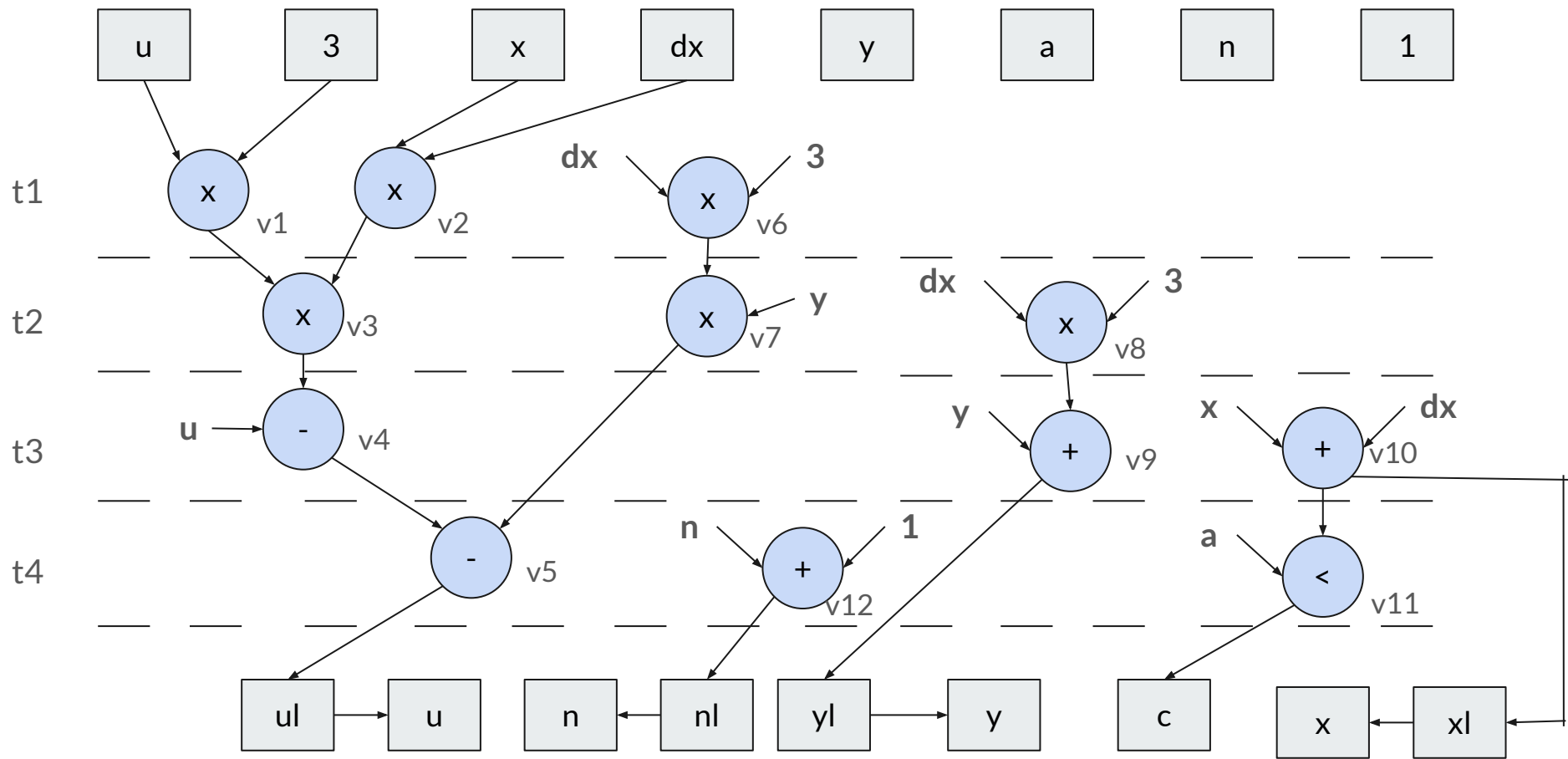


Figure 3: Game theoretic scheduling, considering a cooperative game



Resource constraints comparison

	ALAP	ASAP	Game Theoretic
Multipliers	4	2	3
Adders	2	4	3



Remarks

- A non-cooperative game could be explored, with multiple possible approaches
- Changing number of clock cycles