Minimum Makespan Problem

MURUN ENKHEE

Agenda

1. **Makespan** Problem Definition
2. **Previous Work**
    1. **Online List** Scheduling Algorithm – Greedy
    2. **Online MR** Algorithm – Current Best Deterministic Algorithm
    3. **Online Rand** Algorithm – Current Best Randomized Algorithm for general case
    4. **Offline** Algorithm – NEAR Optimal
3. **Input Sequence** Generation
    1. **Uniformly** Distributed Randoms
    2. **Normally** Distributed Randoms
    3. **Zipfian** Distributed Randoms
4. **Report Table**

What is **Makespan** Problem?

Basic **Legendary** **Classic** SCHEDULING!

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… N jobs

What is **Makespan** Problem?

Basic **Legendary** **Classic** SCHEDULING!

… N jobs

Call me MACHINE

Call me MACHINE

M machines

What is **Makespan** Problem?

Basic **Legendary** **Classic** SCHEDULING!

… N jobs

Call me MACHINE

Call me MACHINE

Let’s minimize the max load /makespan/

What is **Makespan** Problem?

Basic **Legendary** **Classic** SCHEDULING!

… N jobs

Call me MACHINE

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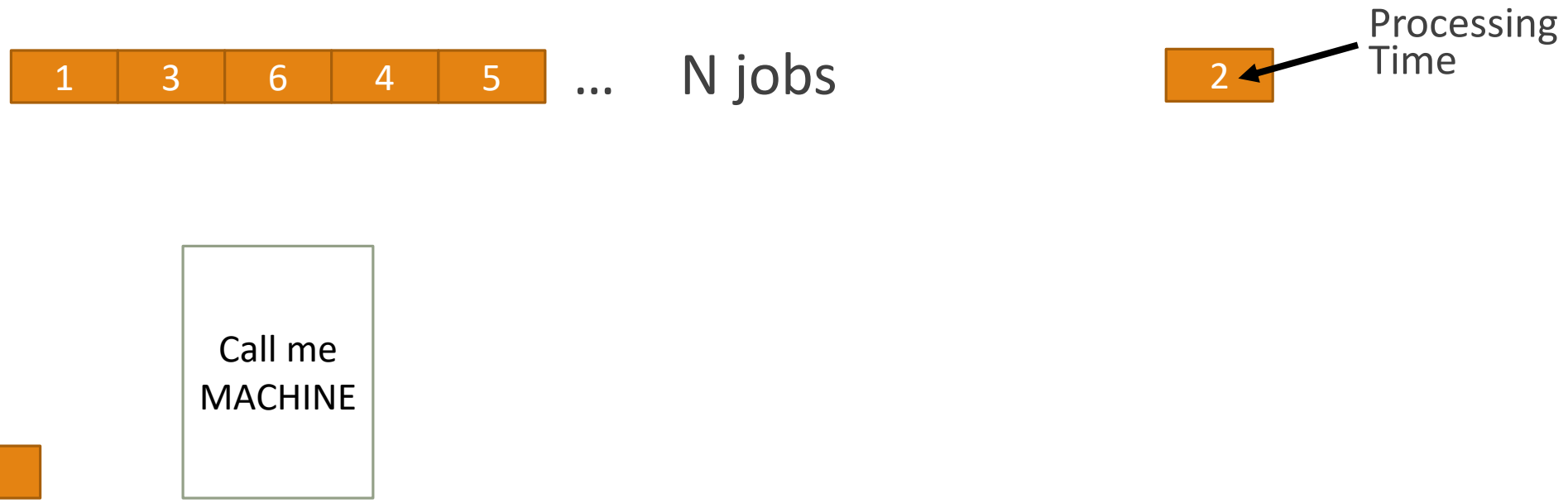
Let's minimize the max load /makespan/

How Would You Schedule, tho?

The Famous Introduced by Graham in 1966

Online **List Scheduling** Algorithm



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Online **List Scheduling** Algorithm

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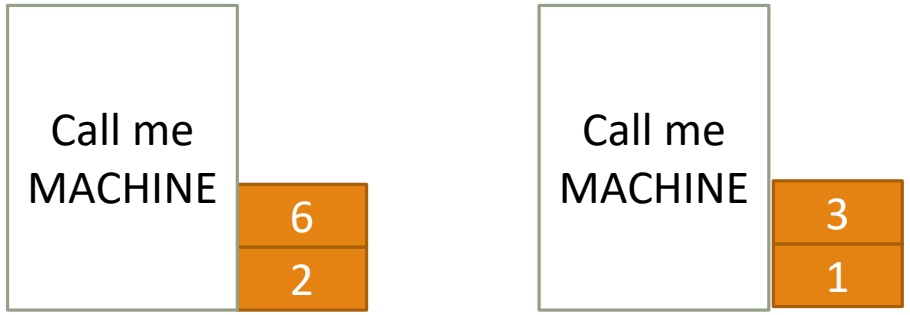

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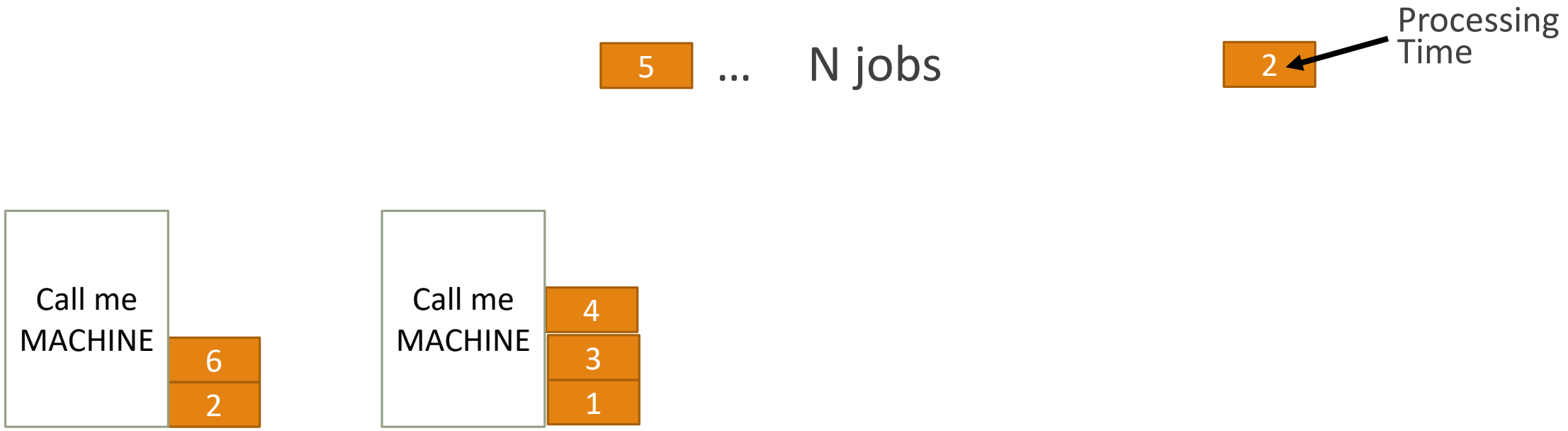
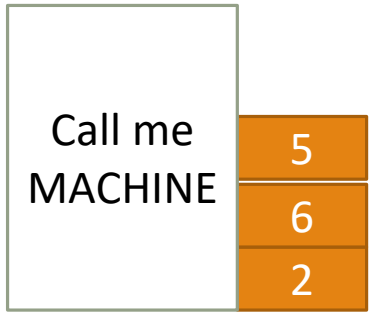
Online **List Scheduling** Algorithm

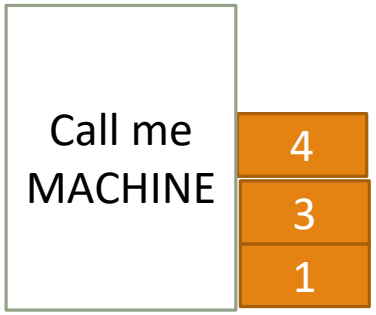


The Famous Introduced by Graham in 1966

Online **List Scheduling** Algorithm

… N jobs

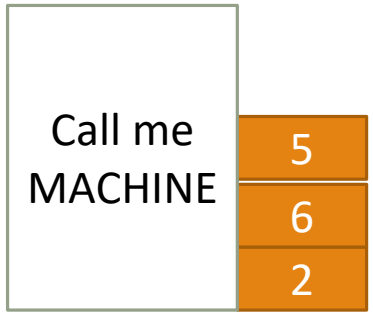


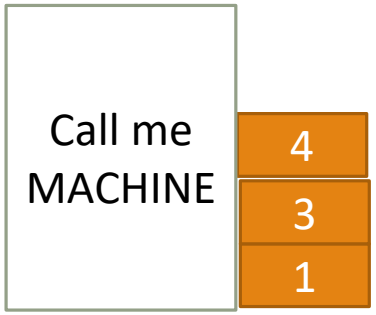


The Famous Introduced by Graham in 1966

Online **List Scheduling** Algorithm

… N jobs





Makespan = 13.

However, OPT can do 11

Previous Work

Upper Bound

(2 – 1/m) – List by Graham 1966

1.986 – Bartal et al.

1.945 – Karger et al

1.923 – M2 by Susan et al.

1.9201 – MR by Fleischer & Wahl 2000

Lower Bound /current best/

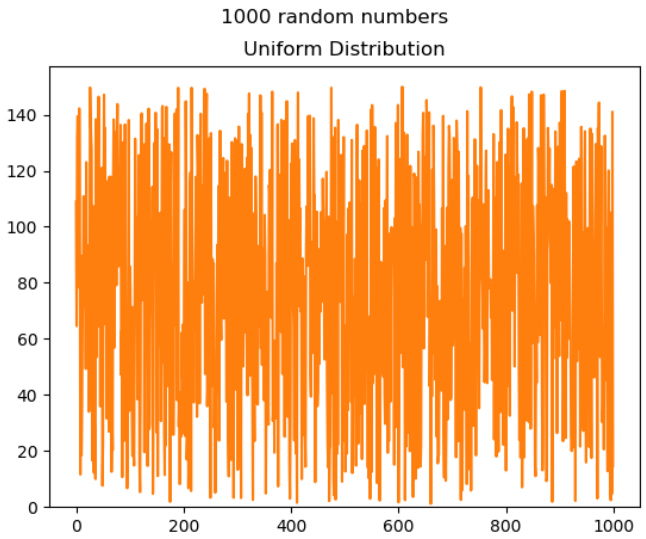
1.853 – Gormley et al.

Randomized Upper Bound /current best/

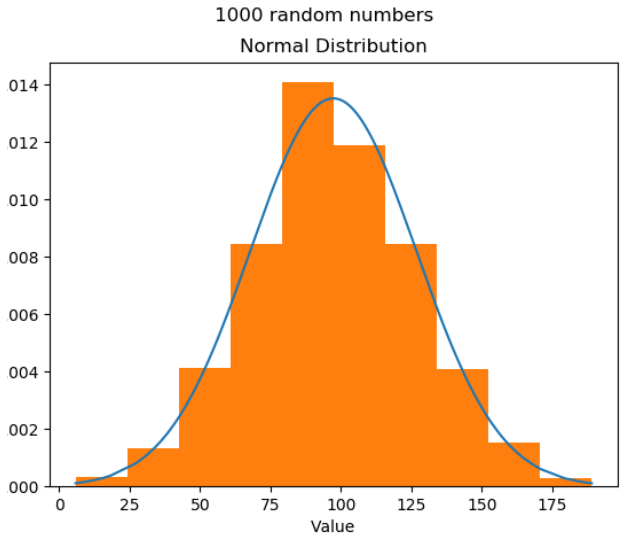
1.916 – Rand by Susan et al. 2002

Generating **Input Sequence**

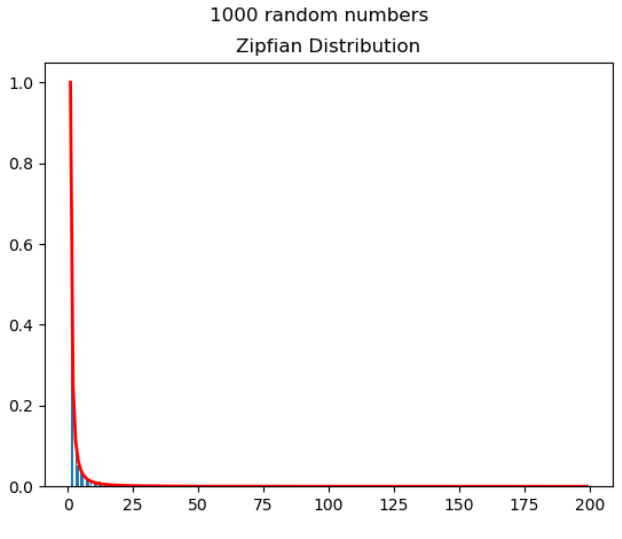
Uniform Distribution



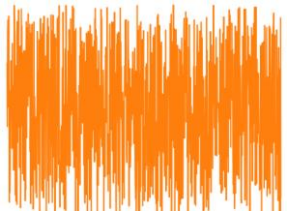
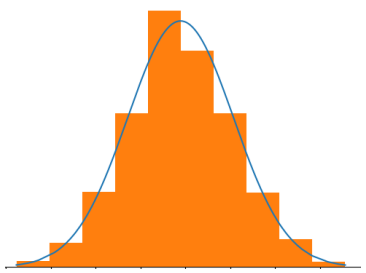
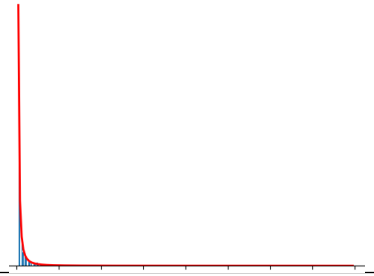
Normal Distribution



Zipfian Distribution



Report Table

Input sequence	Number of Jobs /n/	# of Machines /m/	Offline Approximation	Online Algorithm		
				Greedy	Current Best Deterministic	Current Best Random /m>7/
				List Scheduling	MR Algorithm	Rand Algorithm /avg of 10runs/
Uniform Distribution 	1000 (1<Tp<150)	5	15161.76	15191	15191	19401.7
		50	1518.65	1586.71	1586.71	1890.23
		150	512.93	588.86	588.86	682.64
	10000 (200<Tp<500)	5	697703.07	697835.85	697835.85	892607.39
		50	69770.44	70036.74	70036.74	83628.11
		150	23323.91	23538.27	23538.27	27806.87
Normal Distribution 	1000 (1<Tp<170)	5	19997.99	20015.61	20015.61	25600.01
		50	2014	2053.66	2291.78	2434.17
		150	689.89	750.39	750.39	868.49
	10000 (0<Tp<650)	5	600335.77	600366.77	600366.77	767888.58
		50	60044.81	60282.12	60282.12	72080.16
		150	20036.75	20332.37	21457.02	24019.45
Zipfian Distribution 	1000 (0<Tp<1034)	5	1034	1211	1211	1175
		50	1034	1046	1046	1043
		150	1034	1036	1036	1036
	10000	5	11361	11529	11529	14714
		50	3974	4068	4068	4038
		150	3974	3998	3998	3991

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