ماكنت دحاري

- Types of Estimate:- (مصطلح) Cost + time estimation

① early Estimated

② Detailed → لما تجين جزء كبير من الميزانية

- early Estimated :-
  ① Conceptual في مرحلة الكونسبت
  ② Elemental estimate.

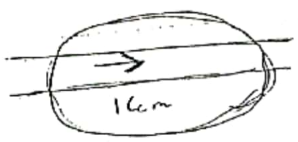
⇒ ① Conceptual Estimates :-

scope → Quantity.
scope → Quality.

- تعريف حجم المستوى مباني كل ⇐ Function
- عدد الغرف
- عدد parking
- ⇐ Servapility

{Cost / unit} , no. of units

\# unit price

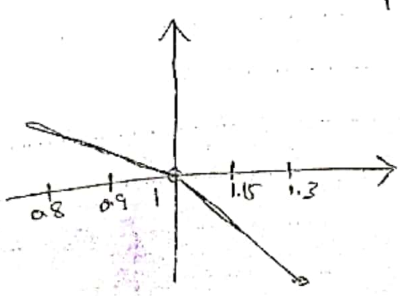


× طولياً = total Cost

2012 → $ 2000/Student Past
2016 → present

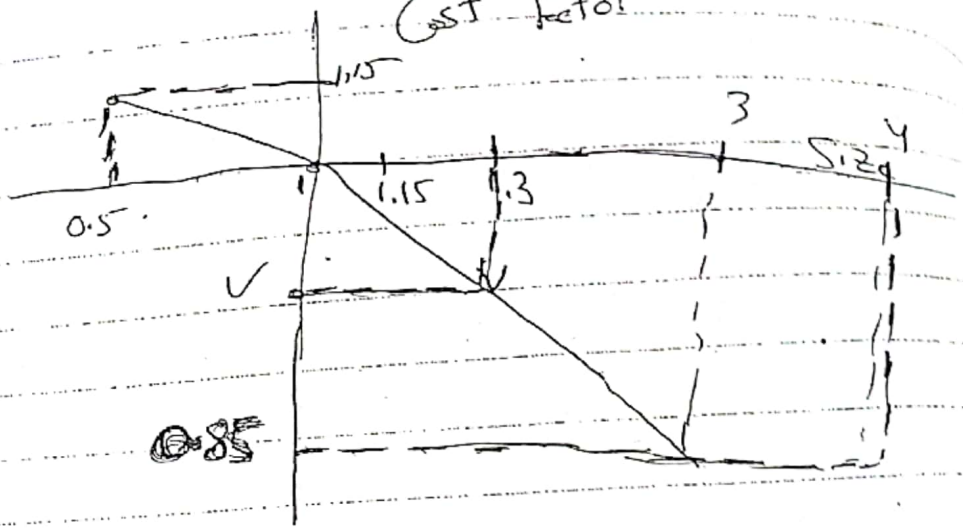
P = Past value $(1+i)^n$

علاقة بين Cost و Size ⇐



Size Factor = $\frac{\text{Proposed}}{\text{Typical}}$

Cost factor



$= \frac{4}{3} = \frac{2000}{1800} = 1.33$

= نسبة الحجم المقترح

$= \frac{\text{proposed size}}{\text{typical size}}$

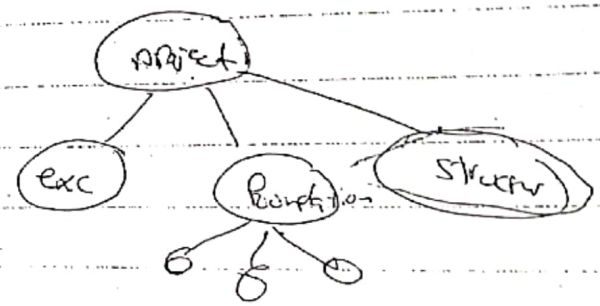
⇒

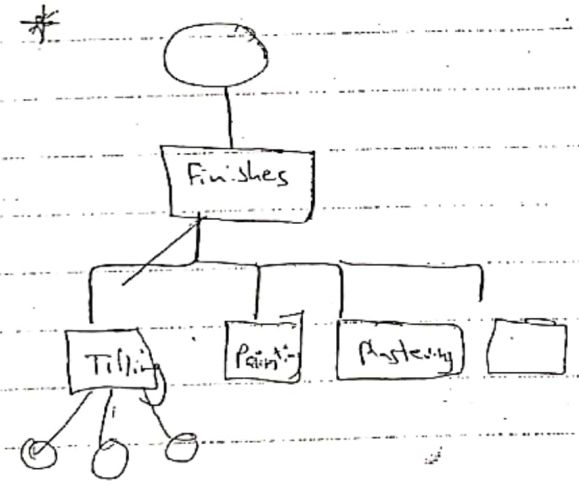
- Detailed estimates:

مقارنة بين اكثر من عرض بأسعار

*

*





⇒ Direct Cost s:

Cost = Direct + Indirect

70-90% From Total Cost

- Material
- Labour
- Equipment
- Sub Contractor

- project overhead P.O.H
- General overhead G.O.H

Sub Contractor Cost ⇒ أسعار مقاولي الباطن

⇐ Feasibility Study ⇐ - Concrete pouring plan. خطة صب الخرسانة

Scanned with CamScanner

- project overhead: المصاريف الإدارية وتبعا للمشروع، يتم توزيعها على جميع activities

Project X
A Direct Cost, A
B D.C.B
C D.C.C

$P.O.H_x = \$ 2000$

$$P.O.H_A = \frac{D.C_A}{\Sigma D.C.} \times P.O.H_x$$

$$\Rightarrow H_B = \frac{D.C.B}{\Sigma D.C.} \times P.O.H_x$$

$$P.O.H_C = \frac{D.C.C}{\Sigma D.C} \times P.O.H_x$$

General overhead → (0 – 15%)

G.H
- مصاريف إدارية أنا كان في شركة مش تحملها على مصاريف المشروع وغيره مثل أو مثل ← site engineer بيشتغل بمصاريف المشروع وغيره.
- أو شركة بها ... وبيشتغل في نفس المشروع، سعر Ticket وغيرها يتم تحميلها على General overhead
- مثل سيارة الشركة التي تراقب كل مشاريع الشركة لذلك تعتبر General overhead
- أنا بقدر أحسب كل واحد لكن project overhead ، ما أنا بحتاج أكثر من جزء للكل General overhead

11. Detailed estimate :-

3. Markup :-

Cost → Direct: labour, Equipment, Material, Sub Contractor
Cost → In Direct: P.O.H, G.O.H

⇒ Price = Cost + Markup (profit)

Risk Contengency ↑ أكبر ما يكون في حالة lump sum
لو تكاليفها . أقل في حالة cost-plus

⇒ Duration = $\frac{\text{Quantity}}{\text{Production Rate}}$

Crew → labour → skilled / un skilled } 25 m^2 / day, day = 8 hrs
Crew → equipment

$D = \frac{Q}{R} = \frac{200m^2}{25m^2} = 8 \text{ days}$.

- Local wether Condition ⇒ مثل الجو في الشتاء والمطر
يزيد يقل Duration

- learning Curve, في بداية المشروع تكون عمالة المشروع بطيئة ثم
Crew efficiency تتعلم مع مرور الوقت حتى تصل إلى أعلى كفاءة

- Labour unrest. مشاكل مع العمال : بيؤثر على productivity factor

- Crew absenteeism, تغيير فريق العمل

- Regularity and Culter habits مثل الصيام

مثلاً يوم الجمعة 8 ساعات مش أكثر من أيام العمل

- Design Changes + rework, ⇒ الإعادة للشغل أكثر من مرة
بالتالي تقلل productivity factor

- over times

- uncertainity → مثل الظروف تتغير، تغيير في المشروع owner تغير ... etc

Modified Duration = Quantity / Production Rate × F

Example:- "Direct Cost" :-

① D = Q / P×P = 1400 ft² / 175 ft²/day =

② Cost => Crew + Material

Crew: 1,800 $/day

= 1800 $/day × 8 days = 14,400 $

Material Cost = 4.5 ft²/day × 8 day × $100/ft² = $3600

Cost = $ 18,000

- Project. over. Head = 10% Direct Cost

Total Cost = 18,000 + 0.1 × 18,000 = $19,800

- Markup = 20% T.C

Price = Total Cost + 0.2 × total Cost

= 1.2 × $ 19,800

= $23,760

⇒ Cost = $ 18,000 ⇒ ⑥ unit Direct. Cost = $ 18,000 / 1400 ft² ⇒ T.C ⇒ Unit

= $12.85/ft²

Unit price = $ 23760 / 1400 ft² = 16.97 $/ft²

Example 2 "Direct Costs":-

Method 1:-

$M(12) = 500\ ft^3$

$M.C. = 500\ ft^3 * \frac{\$17}{ft^3} = ?$

Crew Cost / day (8 hrs)

$= 2L_1 \left(\frac{\$15}{hr} * 8\ hrs\right) + 3L_4 \left(\$\frac{25}{hr} \times 8\right) + 1E_2 \left[\frac{\$50}{hr} \times 8\ hrs\right]$

$+ 2E_{14} \left[\frac{\$20}{hr} * 8\right] = \$1560/day$

$\Rightarrow$ Duration $= \frac{Q}{P} = \frac{500\ ft^3}{\frac{100\ ft^3}{day}} = 5\ days$, (5 days)

Crew Cost = Daily crew cost * Duration = ?? $7800

T.D.C = 8500 + 7800 = $16,300

Method 1 → without overtime,

Method 2 → بتكاليف الوقت

$\Rightarrow$ Method (2):- " 14 hrs / day) / 8 hrs + 6 hrs

Out put $= 100\ ft^3 + \frac{6}{8} \times 100\ ft^3 \times \underbrace{0.9}_{\text{overtime}}$

out put $= 167.5\ \frac{ft^3}{days(14\ hrs)}$

$\Rightarrow P = \frac{167.5}{100} = 1.675 = P$

Out put لليوم الواحد

$\Rightarrow$ Duration $= \frac{500\ ft^3}{P \times 100} = \frac{500}{167.5\ \frac{ft^3}{day}} =$ 3 days

Crew Cost / day (14 hrs).

$= 2L_1 (\$15 \times 8 + \$15 \times 6 \times 1.5)$

$2L_1 * 15[8 + 15 \times 6] + 3L_4 \times 25[8 + 6 \times 1.5] + 1E_2$

$[\$50 \times 14\ hrs] + 2E_{14} [\$20 \times 14]$

$= \$7170$ [5045 $]

Total crew Cost = $\Rightarrow 9135 + 8,500 =$ $17,635

- Normal Cost
16,300
$500 x 5 = 1500

overtime Cost
17,635 ⇒ $ 1335

2days

Indirect Cost day
= $500/day
= 10 - 0%
-335 $

⇒ Normal Cost is cheaper than overtime cost.

Example "Indirect Cost" :-

⇒ D.C.
→ Activity = $ 1 x 10^6
→ Project = $ 10 x 10^6
→ P.O.H = $ 1 x 10^5
→ profit = 10% Total Cost

- P.O.H = $\frac{\$\ 1\times10^6}{\text{Activity}\ \$\ 10\times10^6} \times \$\ 1,00,000 = \$\ 10,000$

- G.O.H = $ 5 x 10^6 / years.
8 projects → D.C. all projects = $ 50 x 10^6

G.O.H = $\frac{\$\ 10,000,000}{\text{Project}\ \$\ 50,000,000} \times 5 \times 10^6 = \boxed{\$\ 1\times10^6}$

G.O.H = $\frac{\$\ 1\times10^6 * 1\times10^6}{\text{Activity}\ 10\times10^6} = \$\ 100,000$

Total Cost activity = $ 1,000,000 + 10,000 + $ 100,000
= $ 1, 110,000

Total price = T.C. Activity @ 1.1 = $1,221,000

unit price = $ $\frac{\text{T. Price}}{\text{No. of units}}$ = $ [illegible] = $ 122,100 /Units.

Excavation → Rock — Q: 500 m³ — Rate: $3/m³ → Indirect = $ 0.75/m³

Soft — 1800 m³ — $2/m³ → " = $ 1.25/m³

Balance. Bid B.13.

0.5 → $1/m³ → Rate

	Q	Rate	
Excavation → Rock	500m³	$ 3/m³	→ Indirect = 0.75/m³ → $15 → Rate 3.75/m³
→ Soft	1800 m³	$ 2/m³	→ // = 1/m³ → $0.5 → Rate = $15/m³

B.B.

Balance Bid

⇒ Rock = 1800 m³, Soft = 300 m³ } → صحيح

- سعر العطاء يكون اكثر ربحا اذا كانت توقعاتها دقيقة

⇒

Lecture 10

- Project Planning:-

* planning for Construction stage

- Master formate → يرتبط بجميع النشاطات
- Unit formate →

estimation مراحل مهم ← planning -

خطوات مهمة WBS

① By type of عمل

② geographic

③ vertically → طابق ادوار للعمارات

④ Horizantly

⑤

A	B
S	S
S	F
F	S
F	F

} العلاقات
الاستخدامية في Constru

الاكثر استخداما ← F S

Bushing
"critical method"

- بناء الـ "project Net work"

1. Characteristic of good plan:-

- Allocate responsipility clearly

WBS ⇒ O.B.S
P.O.S

X → (y)

- allocation through account
- Be appropriate,

* Daily Crash action → [illegible]
Construction & planning [illegible]
- Construction [illegible] planner [illegible]
- Be flexible.
- Be definite
- Be ordery ⇒ activity
- provide Continuety of work.
- provide Balance of work where possible.
- Exploit existing Resources to Maximum.
- Have Consulted with all intrested parties.

The Cost of planning:-

← Cost Indirect [illegible] Direct
activity [illegible] planning ← Indirect Cost
project overhead [illegible]

Saturation point [illegible]
[illegible] Range [illegible]

planning steps:-

① W.B.S:- Cost الترتيب الهرمي كل ما نزلنا للأسفل
'Detailed planning' كل ما نزلنا يزيد of planing.

طريقة النزول لل Detailed plan قدرما نزلنا "Level".

- Master format . Detailed ?, تكون عارفة التفاصيل
Unit format // ما هاي وكو عارفة تجهيز العمارة

أنواع activity:-

① production activity ⇒ production هو الموجود في Master plan
activity فقط ، متطلبات الأعمال مواد subcontractor.

② Procurement activity:- مثال كهربائية خطط الطوارئ وتوريدة حتى تصل الموقع تعتبر procurement act.

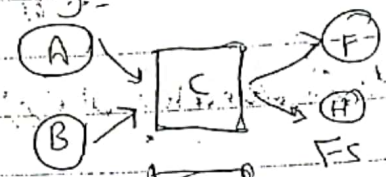
③ Hammock activity ⇒ Construction of ... Slab, Summery activity هي

A ⟶
A1
A2
A3
A4

④ Dummy Activity:- they consumed zero time.
start + end activity هي
مثال بلطة السيراميك بعد ... "التبليط".

- project planning:

* production activity ⇒ أي نشاط activity



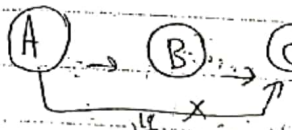
FS
SS
SF
FF

العلاقة هي
- finish to start
↓
عند انتهاء C يبدأ

Fs ⇒ Finish A
To start C

	IPA
A	-
B	-
C	A/B
D	C
F	

Finish to start

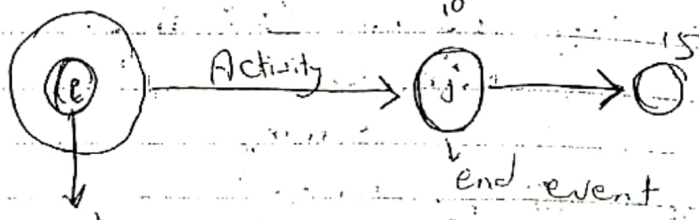


redundant Relationship

Depends upon ⇒ IPA
يعتمد على

⇒ ③ Draw project Networks

- Activity - on - Arrow (AOA)



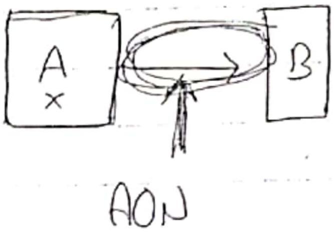
i ⇒ pushing
j ⇒ pulling

activity هو السهم

Activity on - Node

4 - logical relation-ship

يتم التعبير عن ال Activity بشكل Node

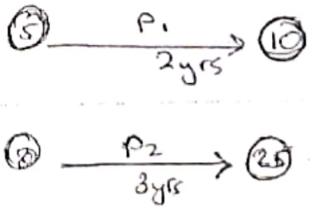


Activity - on - Arrow

Finish to start link

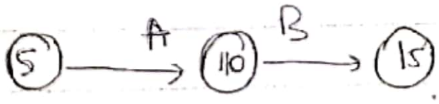
لكل activ ⇐ لازم تكون لها كود مختلفين

Code ⇒ uniq number.



Lean planning

	IPA
A	–
B	A(FS)
C	



ملاحظة

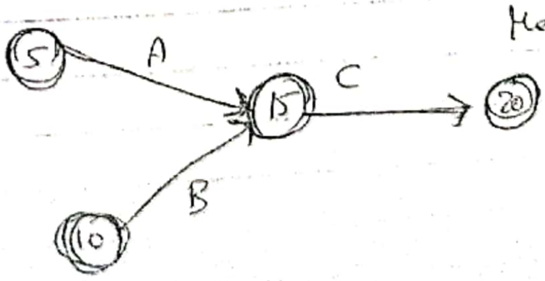
1) you have to minimized # of circle.

2) كل العلاقات relation

اتجاه السهم من الشمال الى اليمين

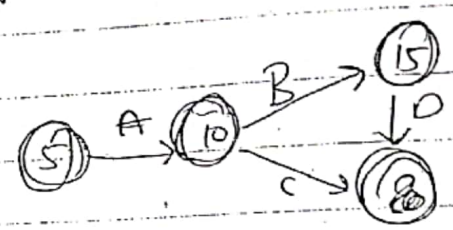
	IPA
A	–
B	–
C	A,B

Merge Relationship



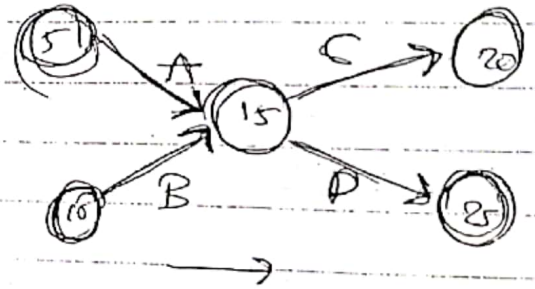
d) A Burst Relationship

A	–
B	A
C	A



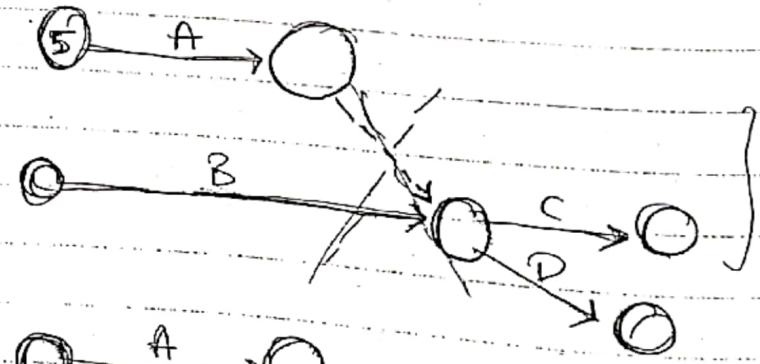
e) Cross Relationship

	IPA
A	–
B	–
C	A, B
D	A, B

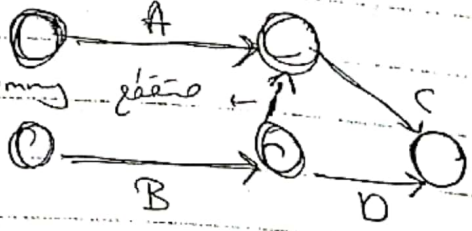


⇒ Dummy activity ⇒

	IPA
A	–
B	–
C	A, B
D	B



- You have to Minimize # of Dummy activity

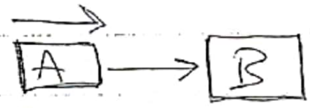


- AOA Representation

Activity on Node

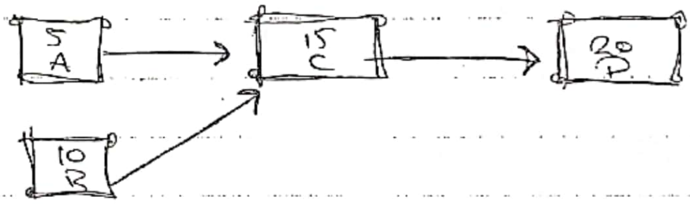
Dummy activity بنزل النشاط لا يوجد فيه } → finishes
الا في حالة ازدواجية العلاقات .

- Independent 

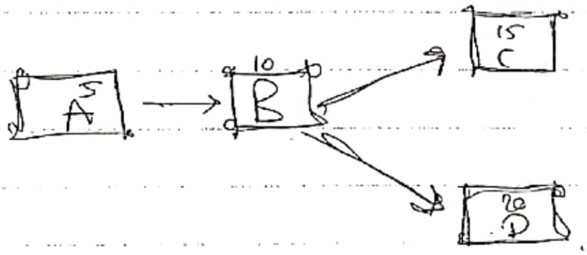
- Dependent 

لما A بيبدأ B

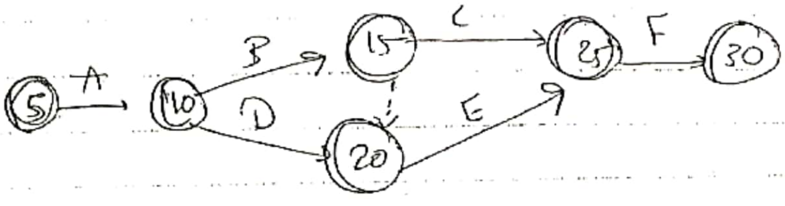
	IPA
A	–
B	–
C	A, B
D	C



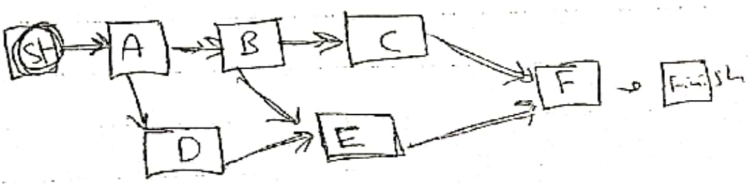
A	–
B	A
C	B
D	B



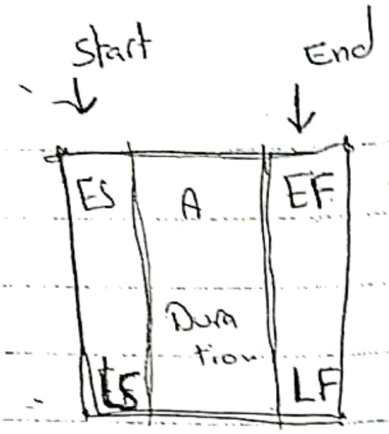
Activity	IPA
A	–
B	A
C	B
D	A
E	B, D
F	C, E

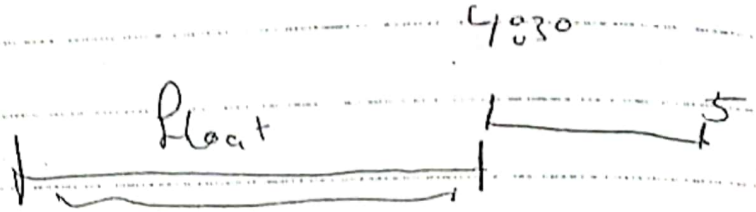


AOA

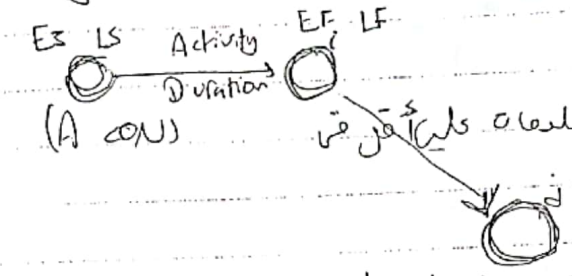


AON

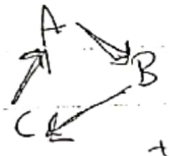




- Activity on Arrow (AOA)



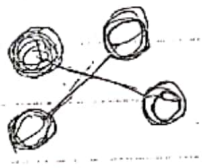
- Node at the start and at the end.



⇒ prevent loop Because Zero = Duration

"activities" تقاطع في نقطة -

two activity across each other



← Crossing error -

⇓ my Drawing will be crowded with lines

" presentation is bad because its because so complex and not understood"

Critical path ⇒ ES = LS, EF = LF ⇒ Critical activity

EF = ES + Duration

LF = LS + Duration

⇒ float = Time available for each activity.

2 ⇒ critical path is 2 ← float بدون

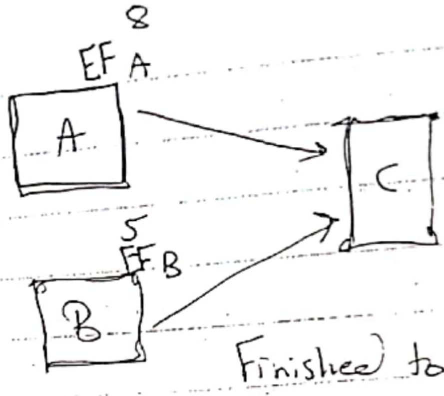
3

5

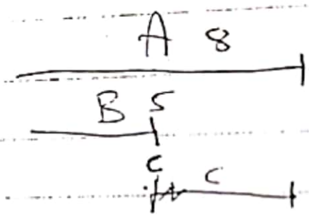
10

⇒ Analysis ignores the longest path.

Tm ⇒ most likely.



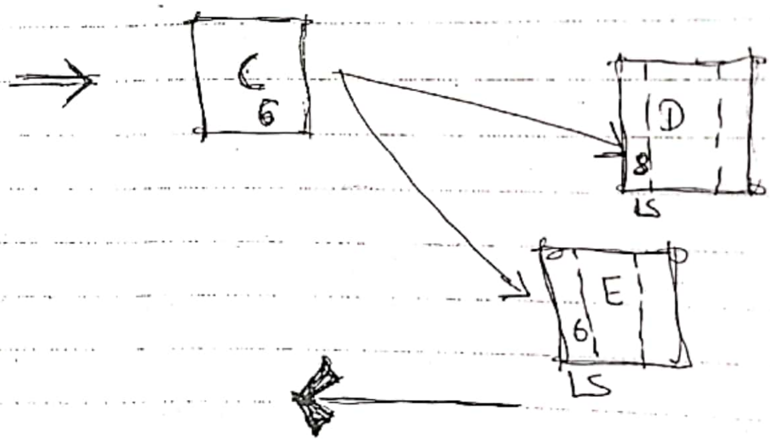
Finished to Start

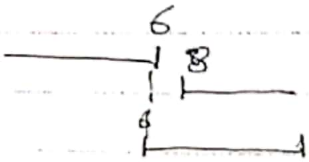


→ early start time

$T_{ES_j} = Max\ EF_i$

$EF_i = Es_i + Duration$



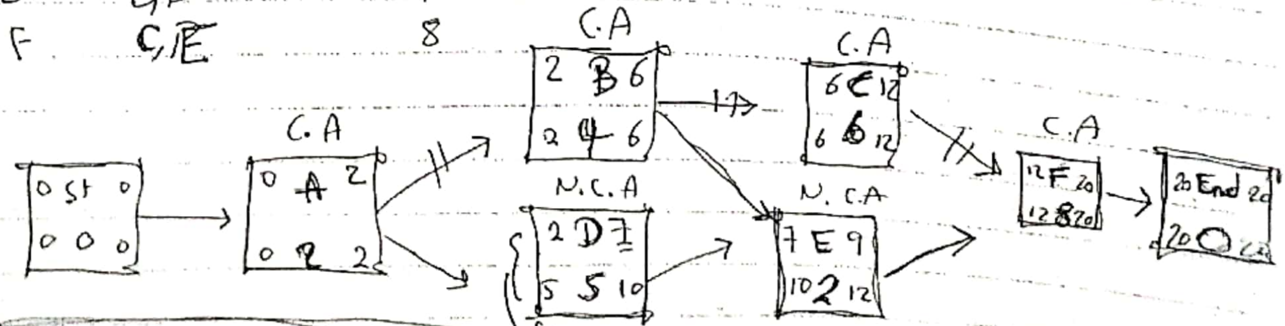


$T_{LF_j} = Min\ LS_j$

$LS_j = LF_j - Duration$

Critical [illegible] activity [illegible] Critical path

	IPA	Duration
A	–	2
B	A	4
C	B	6
D	A	5
E	B,D	2
F	C,E	8

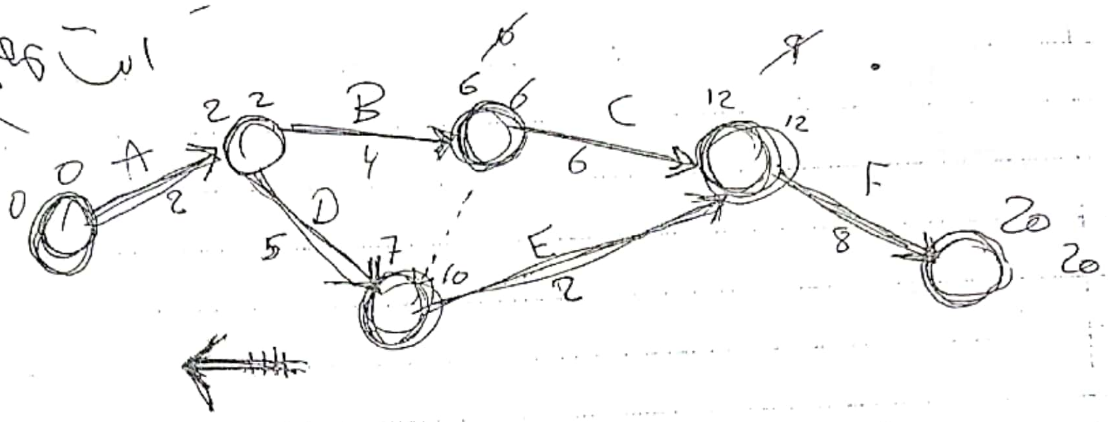


Critical path → A → B → C → F

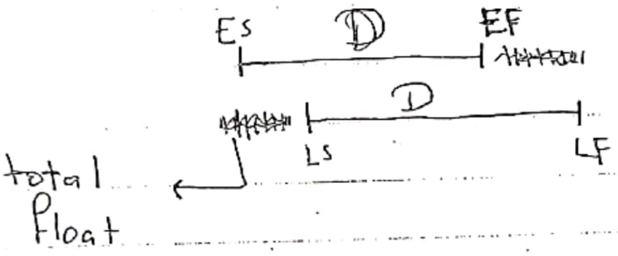
5 - 2 = 3

Cost + time estimation

النظري سيأتي



total float = path كامل



دائما

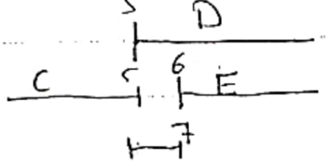
N.C.A → N.C.A ⇒ total float تقل

N.C.A → C.A ⇒ not affected . لا يوجد تأثير

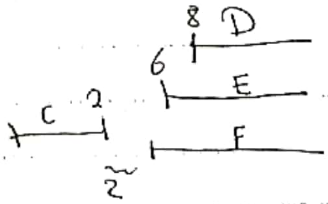
10%

| 6-4 |

FF ← هو جزء من total float ← وعادة تساوي total float او اقل والاولوية تكون اكبر منه



total float = 2



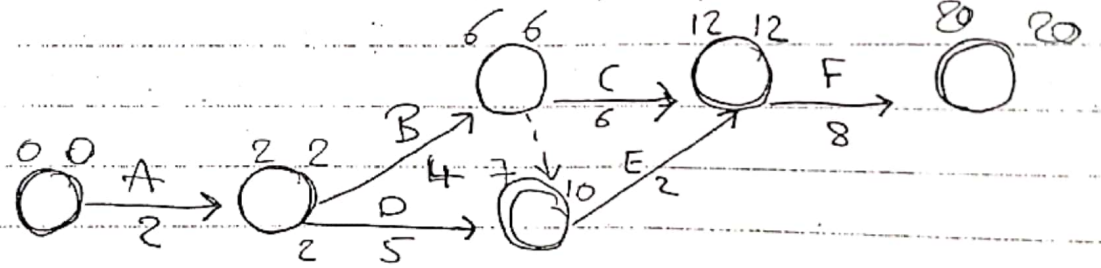
$FF = Min \; ES_j - EF_i$

$TF = FF + I.F$

Activity	IPA	D
A	-	2
B	A	4
C	B	6
D	A	5
E	B, D	2
F	C, E	8

Using AOA !!

Find Es, EF, LS, LF, C.P, T.F, F.F, I.F



	Es	EF	LS	LF	TF	F.F	I.F
A	0	2	0	2	0	0	0
B	2	6	2	6	6	0	0
C	6	12	6	12	0	0	0
D	2	7	5	10	3	0	3
E	7	9	10	12	3	3	0
F	12	20	12	20	0	0	0

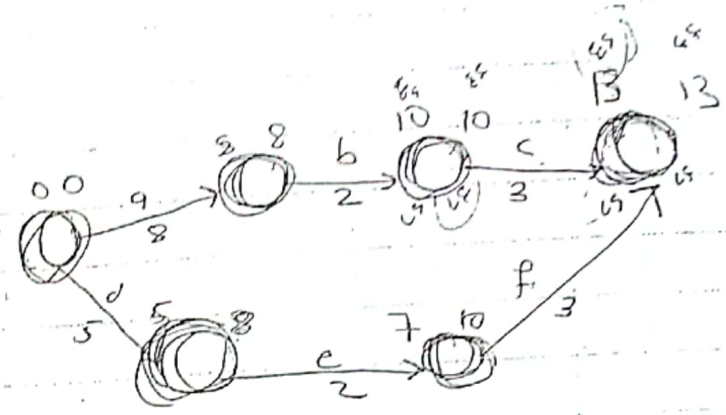
C.P → A → B → C → F

F.F = Free Float = Min Es − EF activity.

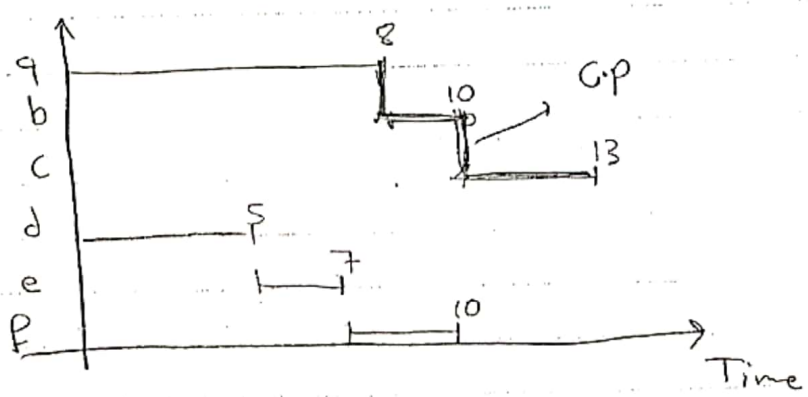
FF = $E_{s_{succ}} - L_F$

Example:- A.O.A

	IPA	D
a	–	8
b	a	2
c	b	3
D	–	5
E	d	2
F	e	3



	Es	EF	LS	LF	T.F	F.F	I.F
a	0	8	0	8	0	0	0
b	8	10	8	10	0	0	0
c	10	13	10	13	0	0	0
d	0	5	3	8	3	0	3
e	5	7	8	10	3	0	3
f	7	10	10	13	3	3	0



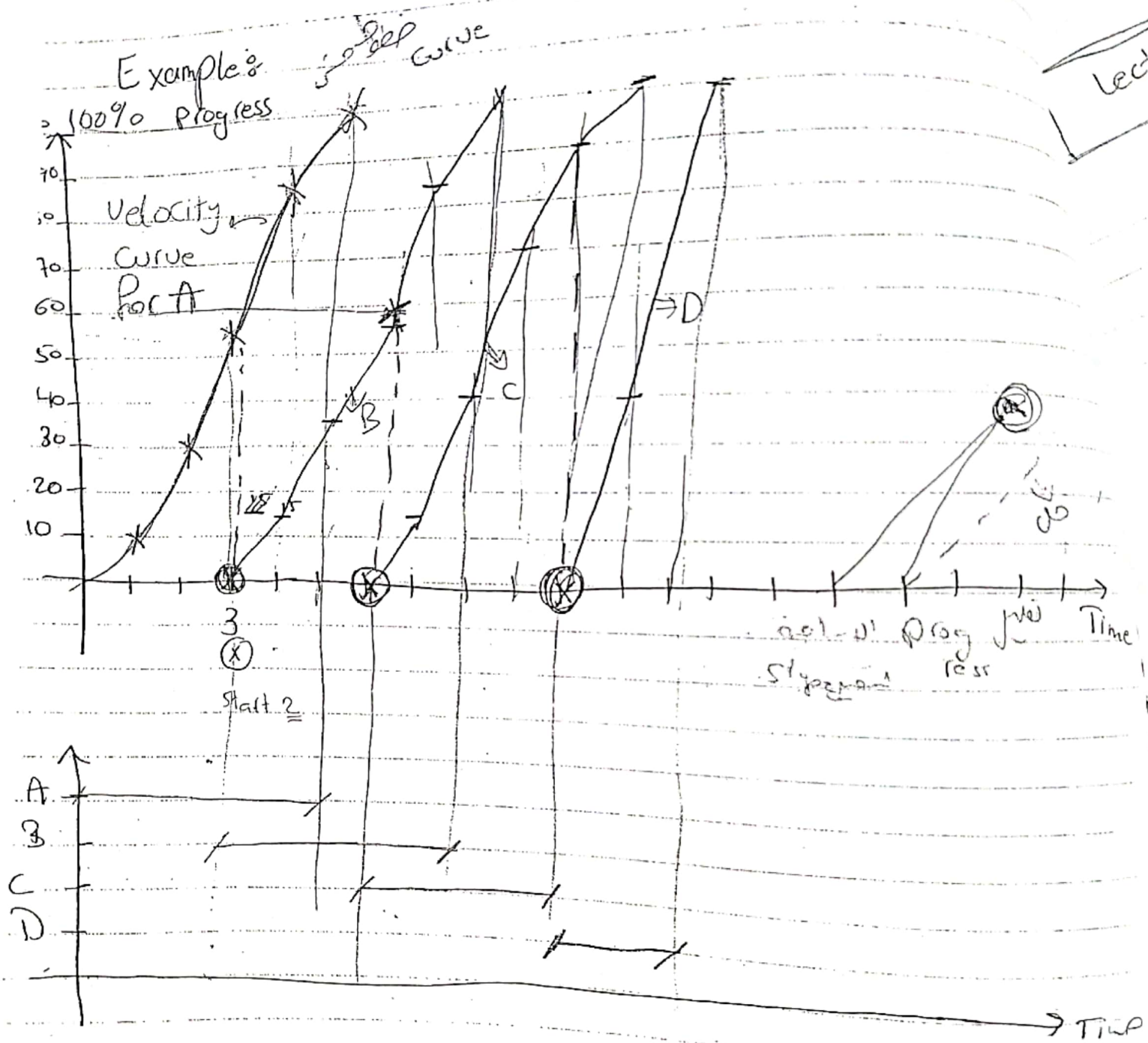
F.F

$E_f = E_{s_f} - L_{F_e}$

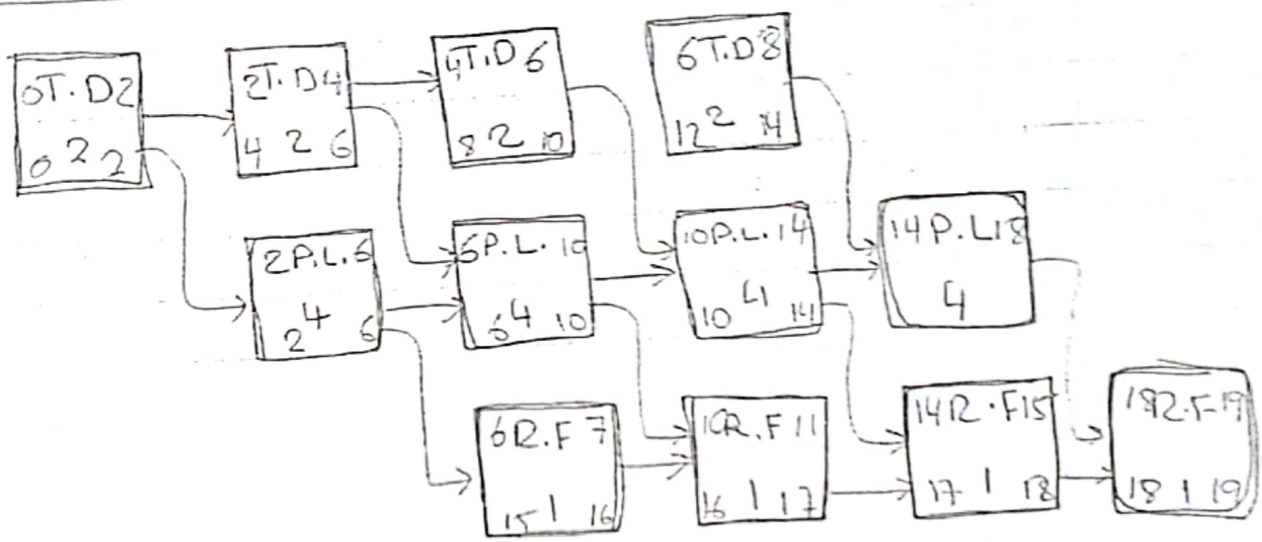
$7 - 7 = 0$

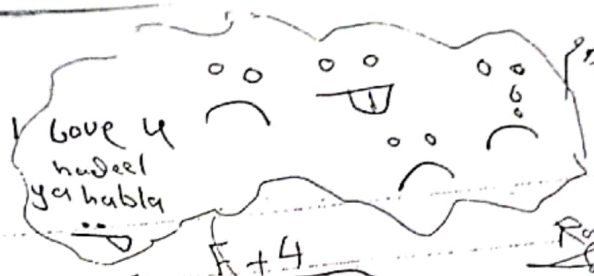
$f_f = E_{s_e} - L_{F_f}$

$13 - 10 = 3$



Lecture 14:-





= 17 ⇒ Min Duration

Ramin

F+4

0	T.D.	8
0	8	14

S+2

2	P.1.	18
2	16	18

F+1

S+4

6	P.1	19
15	4	19

critical path

Ls = late start

R.L = Refilling

ES ⇒ early start

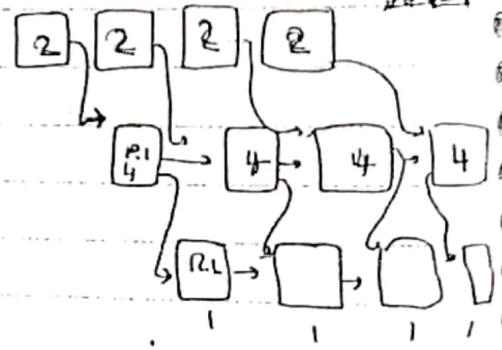
(S) (F)

Leads and lags

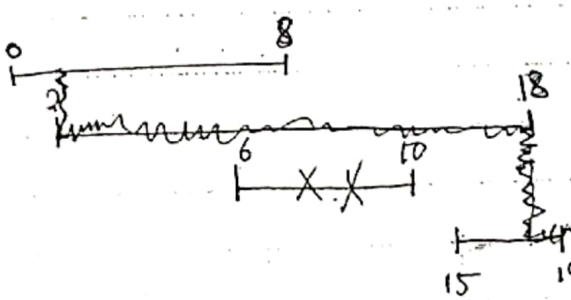
S = Min time between Starts.

F = // // // Finishes

1. Es = Es prec. + $
2. EF = ES + Duration } which is greater
   = EF prec. + F } or



3. LF = LF succ. − F
4. LS = LF − Duration } Which ever
   LS succ − S } or is smaller

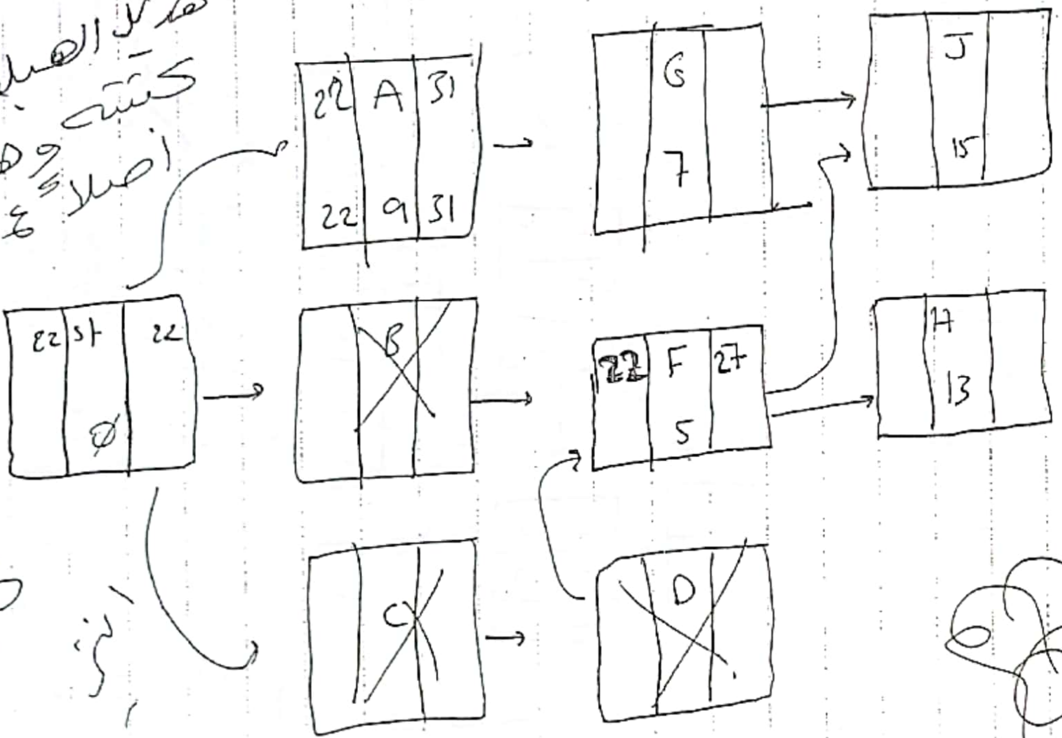


⇒ over lap = $\frac{0}{L}$ = 6

L = 3

⇒ over lap = 6 + 3 = 9

هذا كل الصلبة كشته وهو محله أصلاً ع السلايد



كال نفر [illegible]

للفتكرى

18/4/2015

الطويسه

للبوزة + أمور

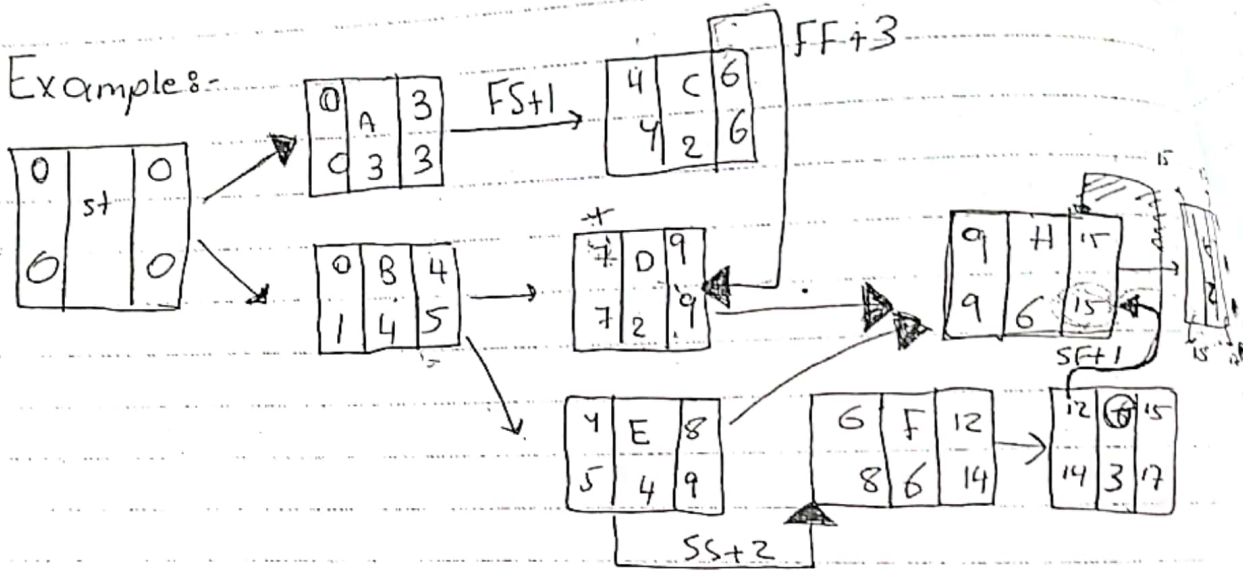
أنا = صلاحية

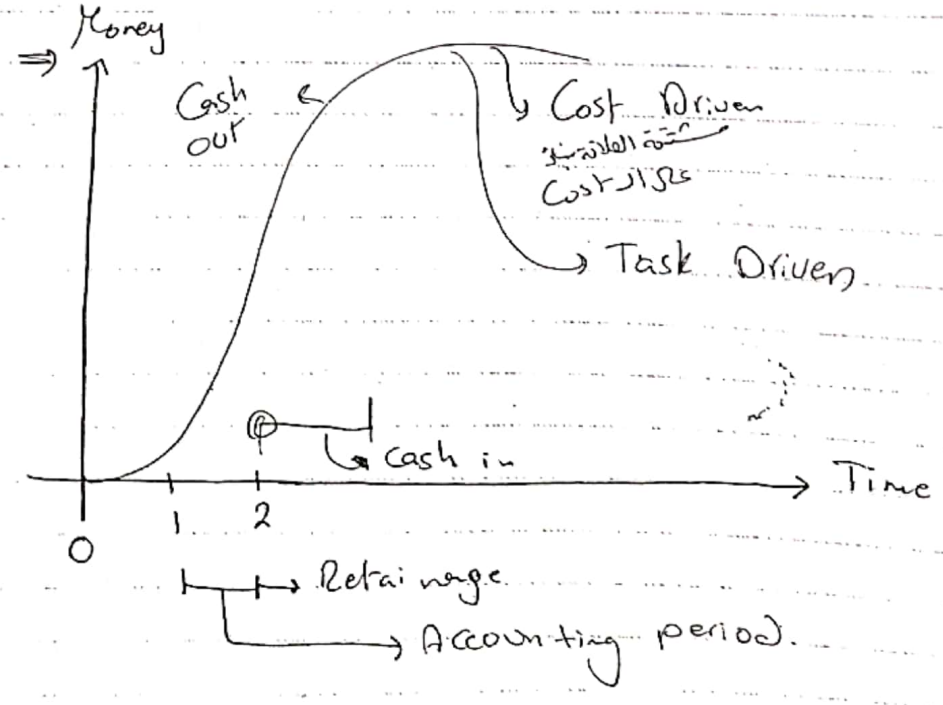
[illegible]

Cash Flow
- Cash in (+)
- Cash out (-)

* أمثلة على الأنشطة الأولى

Example:-





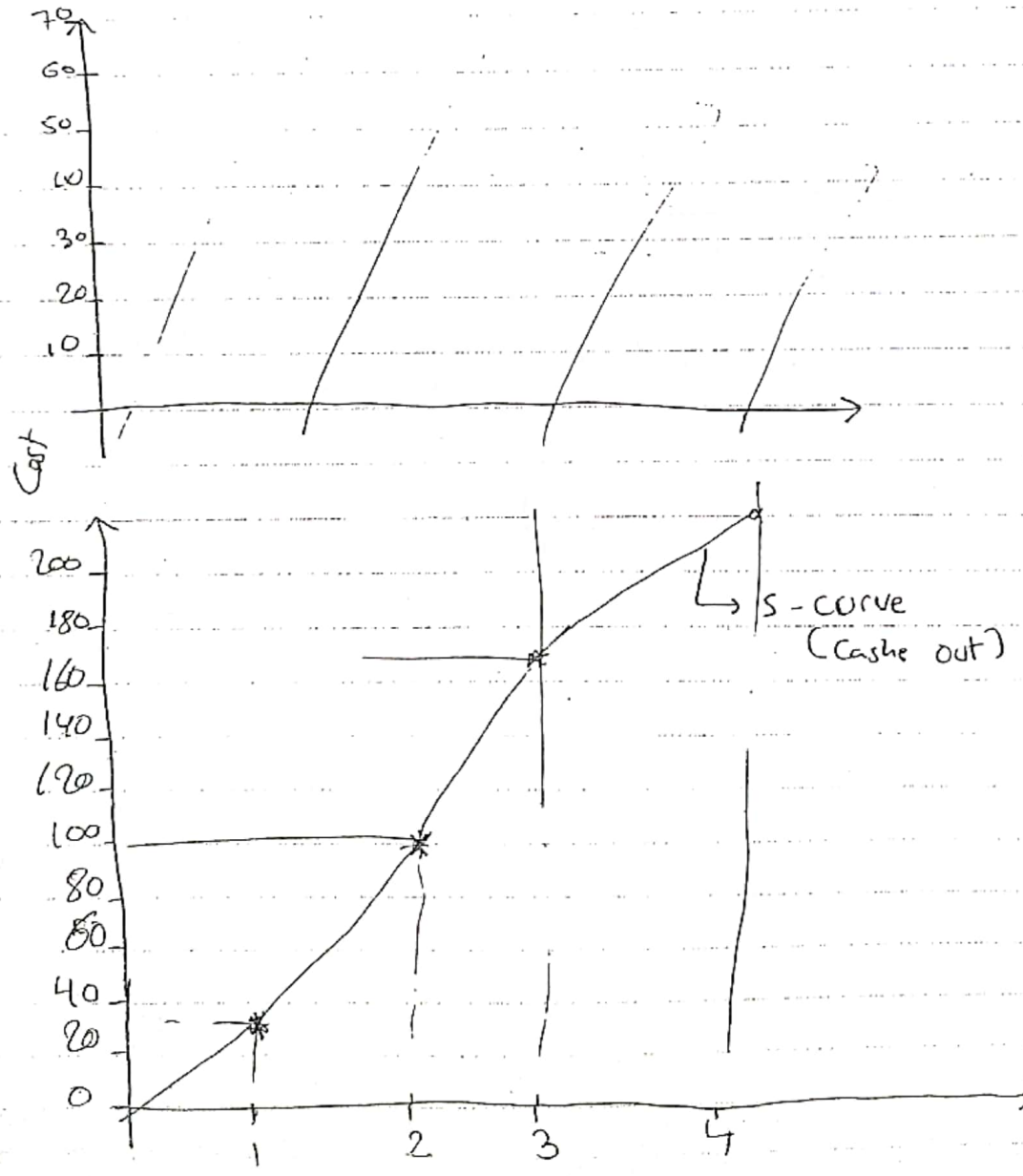
- The Cost for the first month $= \frac{1}{2}A + 5{,}000 = 30{,}000\$$

$\boxed{A = 50}$

- The Cost for the 2nd month $= \frac{1}{2}A + \frac{1}{2}B + \frac{1}{3}C + 5{,}000 = \$70{,}000$

- // // // // 3rd // $= \frac{1}{2}B + \frac{2}{3}C + \frac{1}{2}D + 5{,}000 = \$80{,}000$

// // // // 4th // $= \frac{1}{2}D + 5000 = \$20{,}000$



Contract Duration
planned Duration
↓
1st year

Contract Value = 200,000 + 0.25 × 200,000 =

⇒ 1st payment = (30,000 + 0.25 × 30,000) − 0.1(30,000 + 0.25 × 30,000)

= $ 33,750

price = Cost + Markup
↓ 25% T.C.
25,000 5,000

2nd payment certificate = (70,000 × 1.25) × 0.9 =

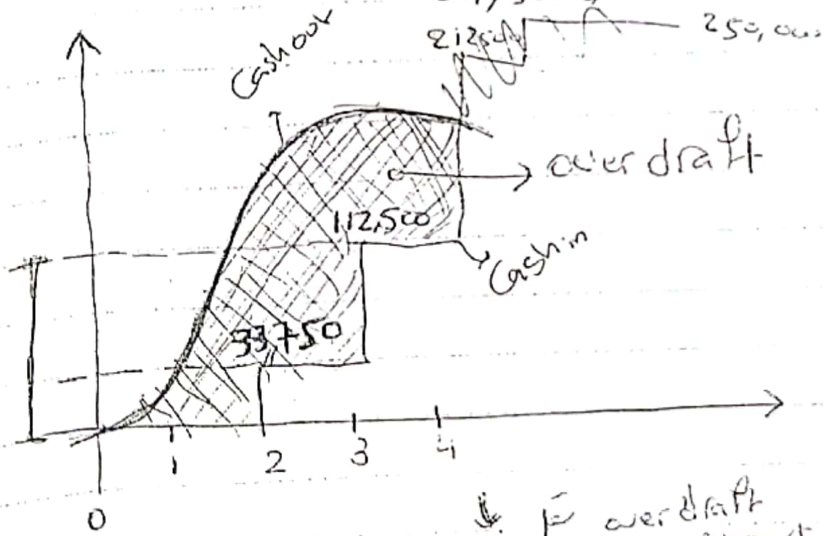
= $ 78,750

3rd payment. C = (80,000 × 1.25) ± Zero (retainage) = $ 100,000

4th payment C = (20,000 × 1.25) + 0.1(30,000 × 1.25)
+ 0.1(1.25 × 70,000)
retainage

T.D = $ 200,000
Indirect = $ 5000 / month
Markup = 25% T.C.
Contract Value = 1.25 × 200,000
= 250,000

1st p.c = 1.25(30,000) − 0.1(1.25 × 30,000) = $ 33,750 (at the end of 2nd month)
2nd p.c ⇒ at the end of 3rd
3rd p.c ⇒ end of 4th
4th p.c. = 1.25 × 20,000 + 0.1 × 1.25 (30,000 + 70,000)
= 37,500 $ (end of 5th)



↓ أكبر overdraft amount ⇐ كل ما زاد markup

Accounting period أكبر ⇒ الاوفردرافت
Retainage ↑ ⇒ overdraft أكبر

D.C	25,000	65,000	75K
Ind.C	5,000	5,000	5K
Subtotal ⇒ DC + Ind.C	30,000	70,000	80K
Markup (25% of Subtotal)	7,500	17,500	20K
Total Billed المبلغ الإجمالي	37,500	87,500	100K
Retainage with held (10%)	3750	8,750	0
Payment Received	—	—	—
Total Cost todate	30K	100K	150K
Total amount billed todate	37,500	125K	225K
Total paid todate	-	—	—
overdraft	30,000	30,300 + 70,000 = 100,300	101,303 + 80K - 33,750 =
Intrest on overdraft (1%)	300	1003	
Total amount financed	30,300	101,303	

33,750

33,750

3rd		4th	
75K		5,000	
5K		5,000	
80K		20,000	
20K		5,000	
100K		25,000	
0		—	100,000
—	78750	—	
180K		200K	
225K		250K	
—	112,500	149,029 - 78,750 + 20,000 = 90,279	212,500
101,303 + 80,000 - 33,750 = 147,553		903	
1,475.53		91,152	
149,029			

5th

200k

250k

—

91,182,109,000 = (8818)

0

(8818)

37,500

250,000

6th

200k

250k

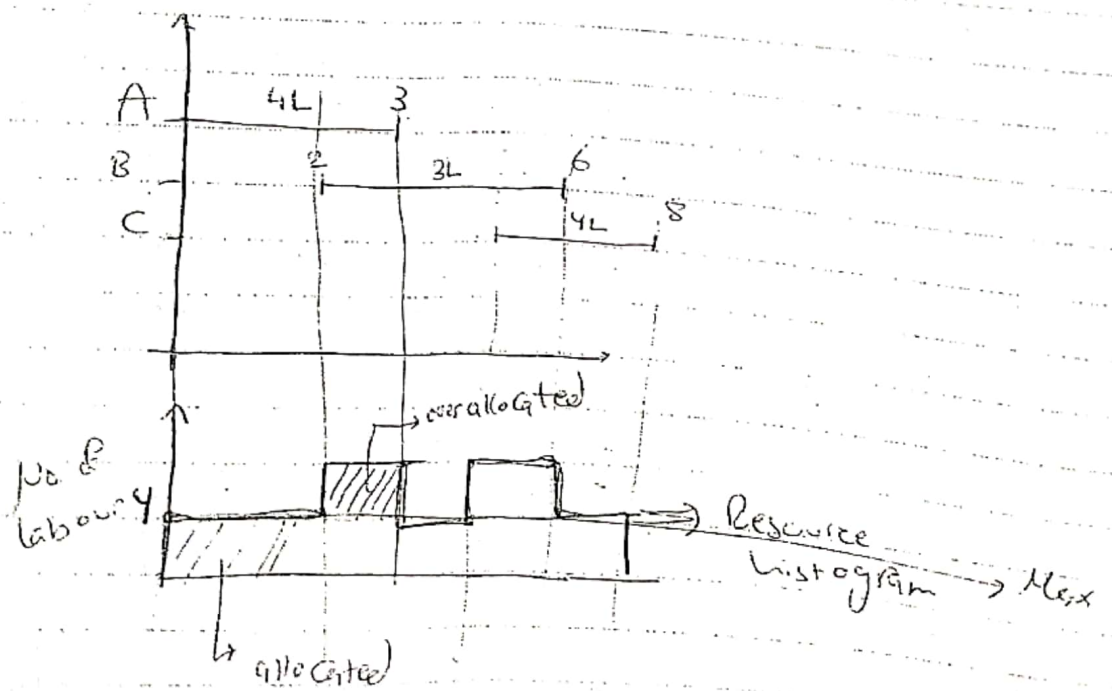
—

(8818) + (37500) = 46,318

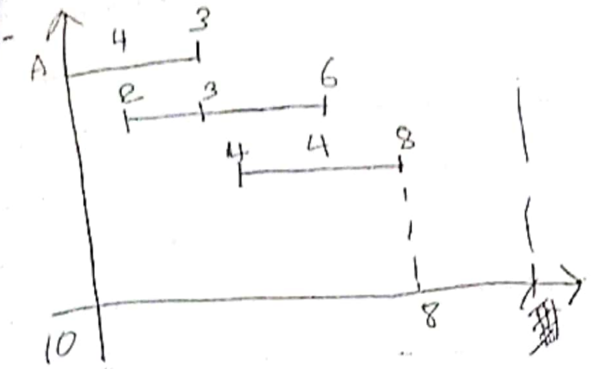
0

(46,318)

Lecture 17:-

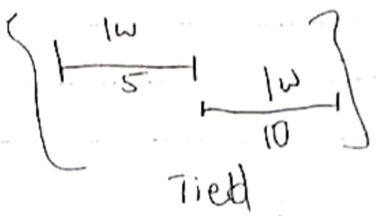


Resource aggregation



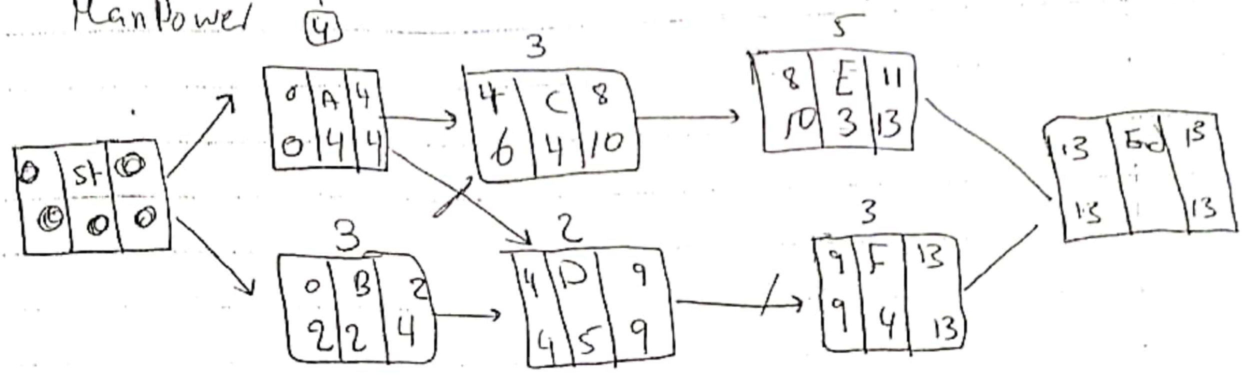
أقل float له priority .

اذا [illegible] لكل [illegible] ES ، ترتيب ⇐ tied activity ⇒
[illegible] Duration نختار Tied activity



→ activity [illegible]

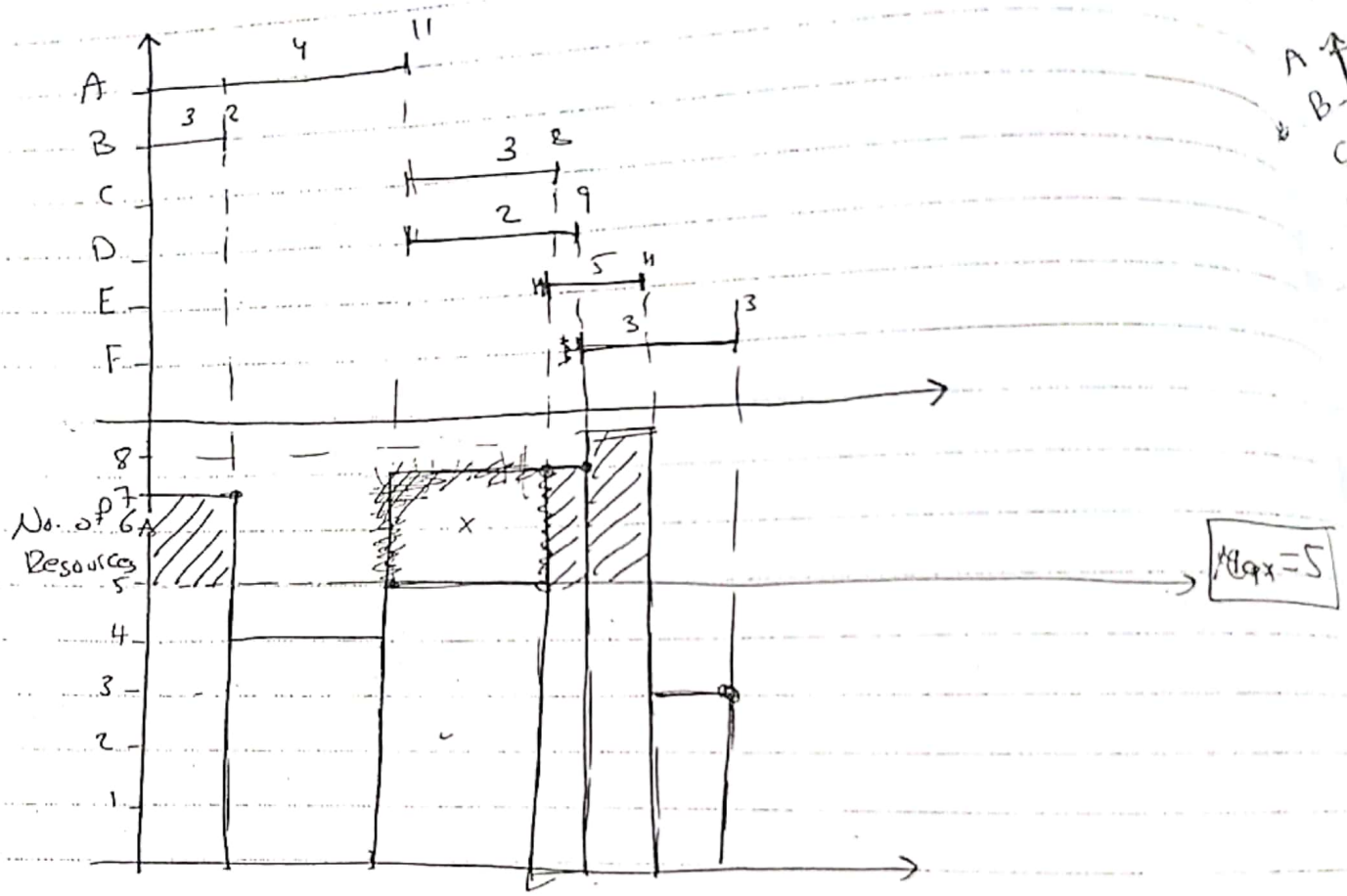
C.P
ManPower ← عمال



Max no. 4 → 4 → 16
Min. no.

C.P → C → P → A → D − F

[5] كل 5 يوم



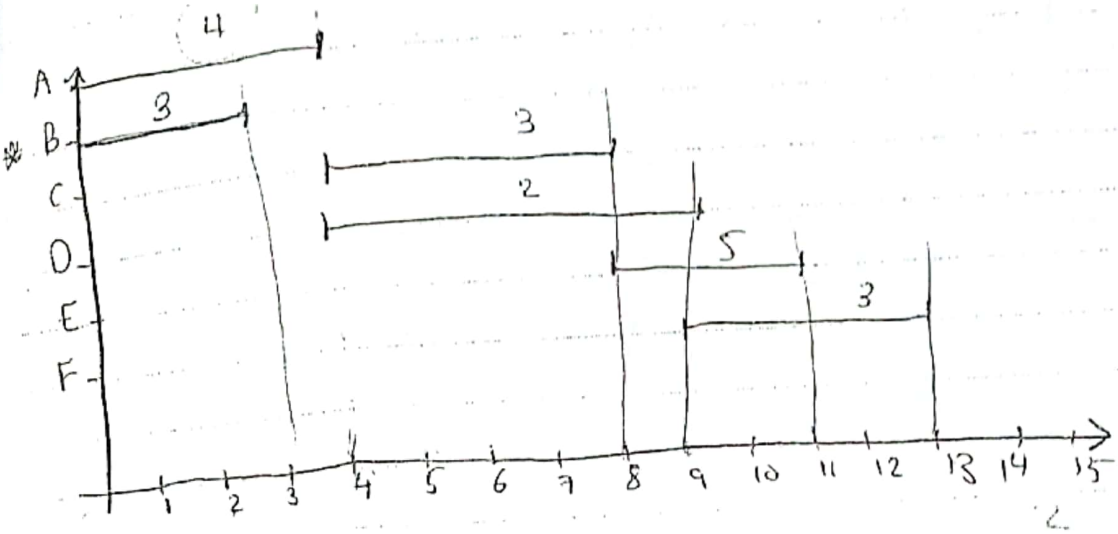
Min	Max	
2	6	A
3	4	B
2	5	C
2	4	D
3	6	E
2	5	F

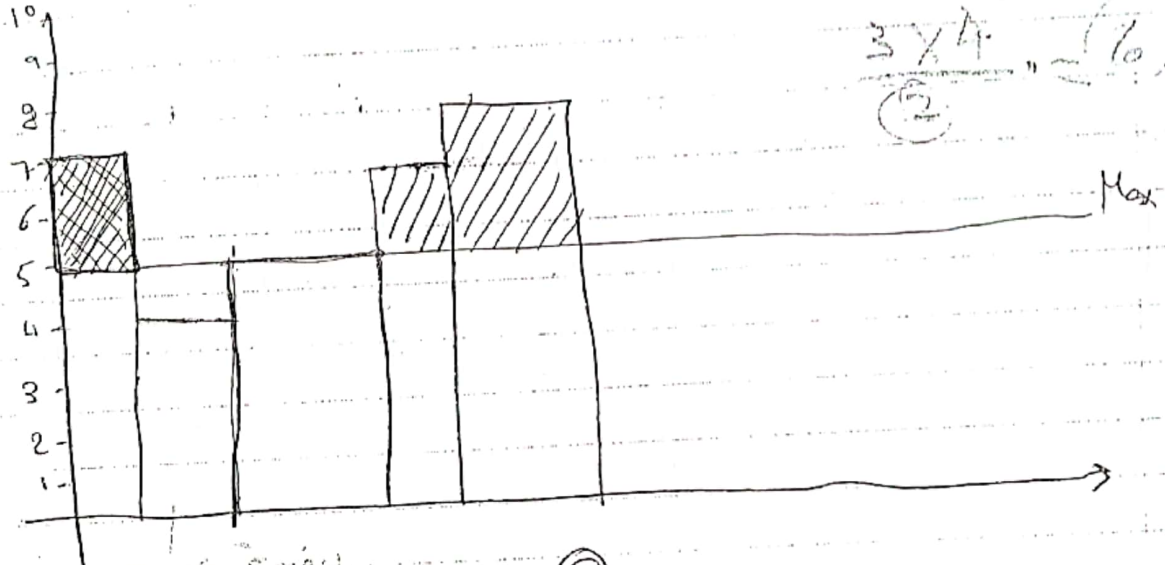
B, A ⇒ Critical activity

4 Rules

- C.A + N.C.A ⇒ C.A.
- N.C.A + N.C.A → Total float ↓
- CA + C.A → (LS)
- C.A + C.A, with Same LS → Less Duration

Duration





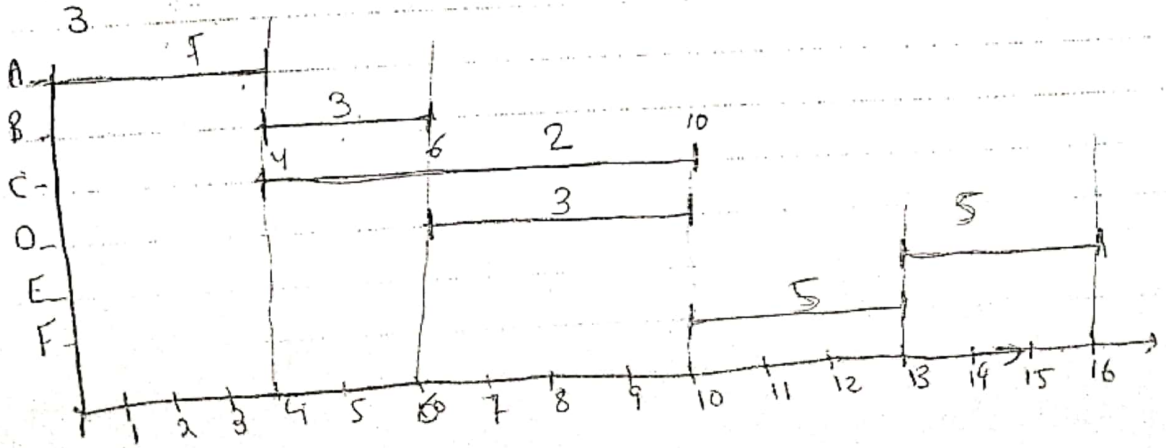
$\frac{3 \times 4}{2} = 6$

$\frac{4 \times 4}{5} = 3.2 = 4$

$3 \times 4 = \frac{12}{2} = 6$

$\frac{4 \times 11}{5} = 4$

$\frac{5}{3} \times 3 = 5$ days

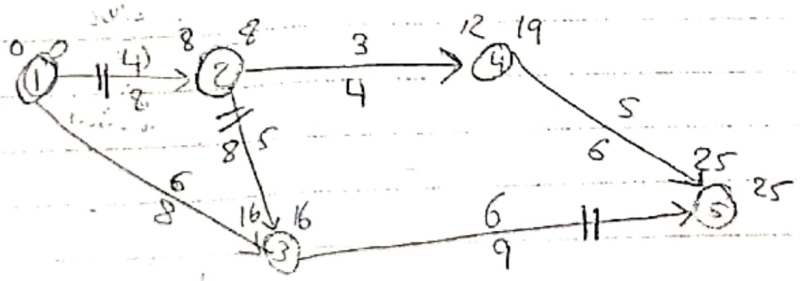


* The project represented in the following table is to be scheduled within a resource limit of 12 men. All men are capable of working on any of the jobs. If not assigned on a particular day, a man is idle but still draws pay. Each job must be assigned a crew of men corresponding to one of the 3 possible crew sizes listed in the table. No in between assignments may be made, the crew size must remain fixed for a job until is finished. Job duration equals man-days divided by crew size for any crew size chosen.

Job	resources requirement (man-days)	crew sizes		
I J	(man-days)	Min	Normal	Max
1 2	32	2	4	8
1 3	48	4	6	8
2 3	40	4	5	8
2 4	12	2	3	4
4 5	30	3	5	6
3 5	54	3	6	9

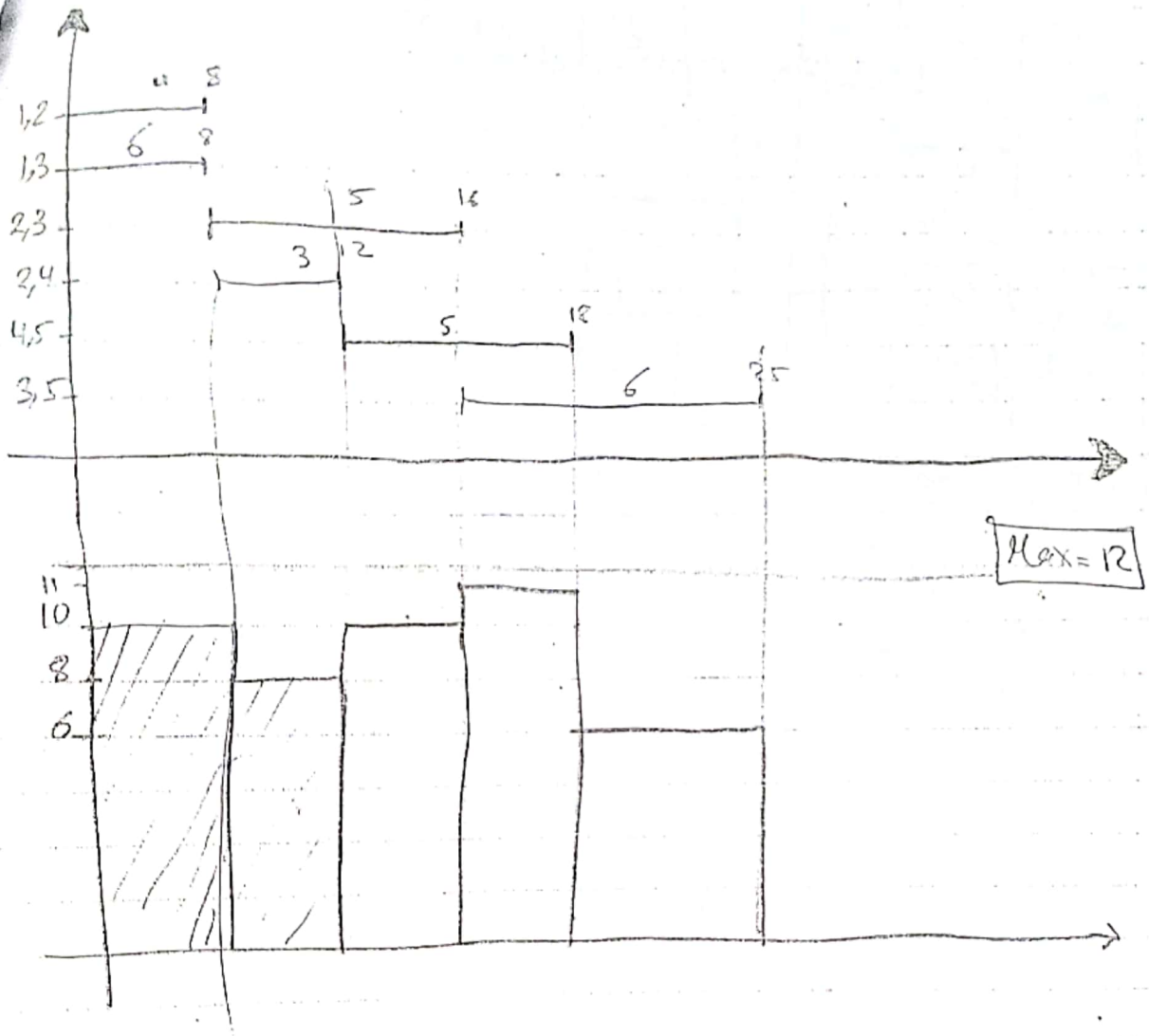
a. Draw the resource histogram (aggrigation) for the normal crew size?

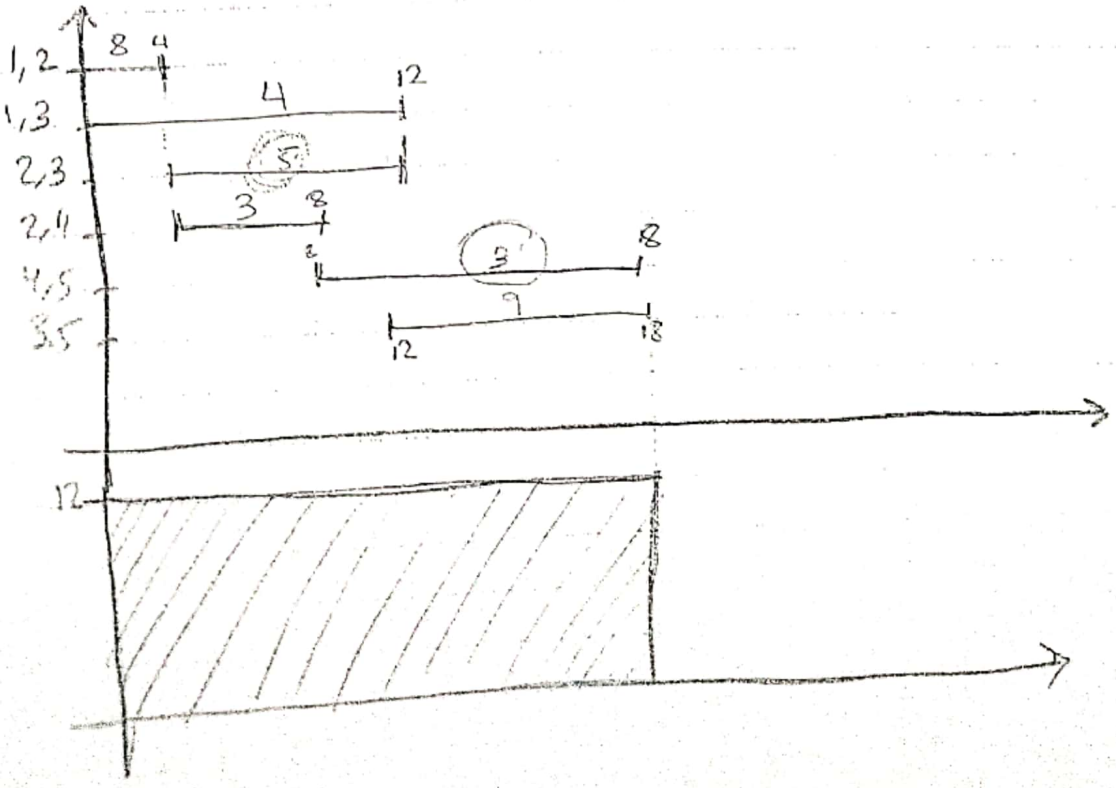
b. Schedule the project so as to minimized idlee man-days over its active span



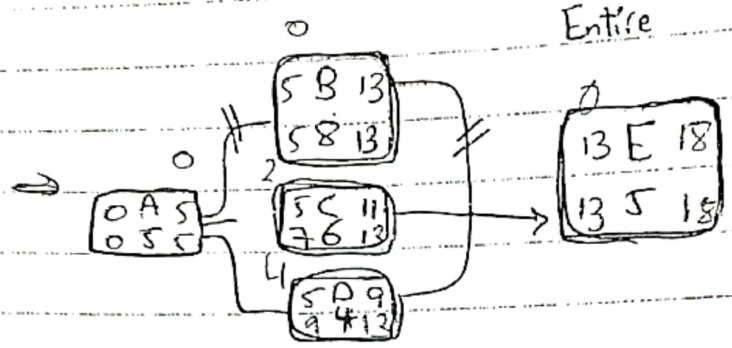
$\frac{32}{4} = 8$

$\frac{48}{6} = 8$





Lect. 18 & Optimization of Entire



Activity	Normal Duration	Crash Duration	Direct Crash Cost	Direct Normal Cost
A	5	3	2400	2000
B	8	2	4500	2500
C	6	4	4500	3,000
D	4	4	2000	2,000
E	5	3	3500	1,000

* Assume the Indirect Cost = $500/week Find the min Cost and duration to Construct this project.

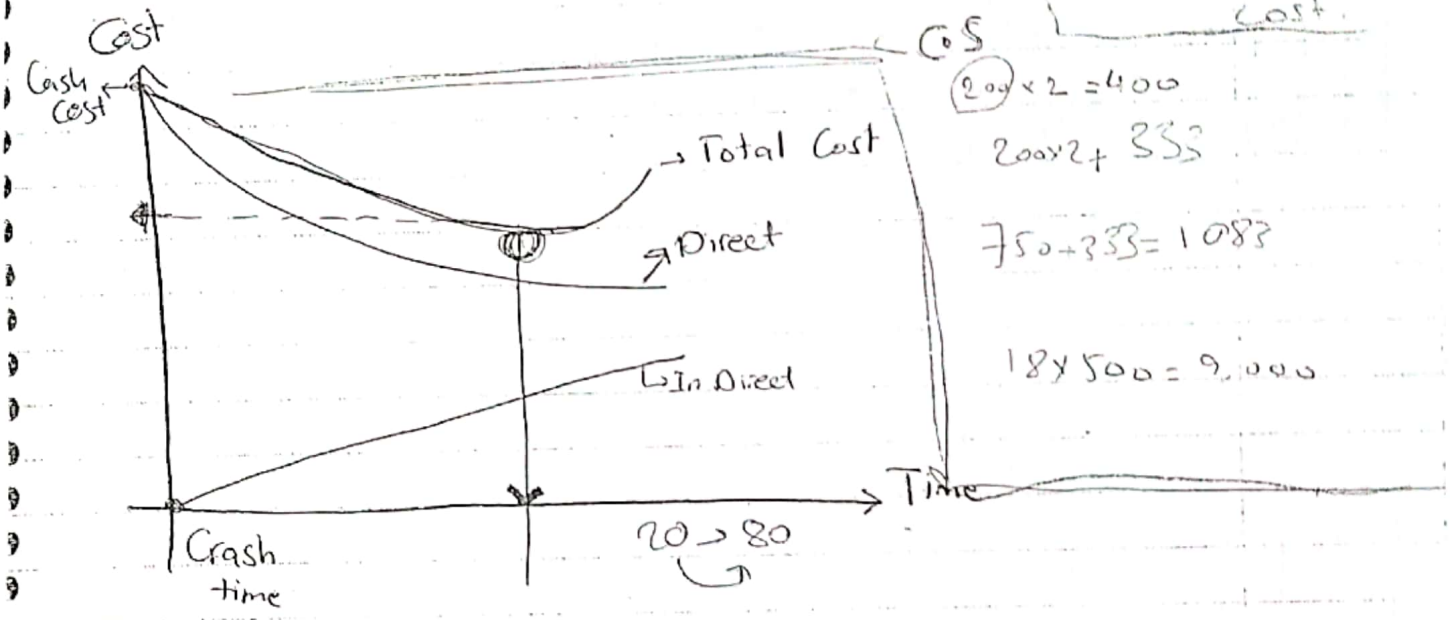
Cost slope = Crash. Cost − Norm. Cost / Normal. Dura − Crash. Duration

	CoS	Ranking
A	$200/week	① with CP
B	$333/week	②
C	$750/week	③
D	—	
E	$1250/week	④

Crash Cost

Crash time

Contact duration (WKS)	18	16	14	12	10	20
Normal direct Cost ($) (2)	10,500	10,500	10,500	10,500	10,500	10,500
Increase in Direct Cost ($) (3)	0	4,00	10,66	3232	5732	0
(4) Total Direct Cost (2)+(3)	10,500	10,900	11,566	13732	16,232	10,500
Normal indirect Cost ($) (5)	9,000	9,000	9,000	9,000	9,000	9,000
Increase in indirect Cost ($) (6)	0	-1,000	-2,000	-3,000	-4,000	1,000
(7) Total indirect Cost ($) (5+6)	9,000	8,000	7,000	6,000	5,000	10,000
Total Cost ($) (4+7)	19,500	18,900	18,566	19,732	21,232	20,500



200 × 2 = 400

200 × 2 + 333

750 + 333 = 1083

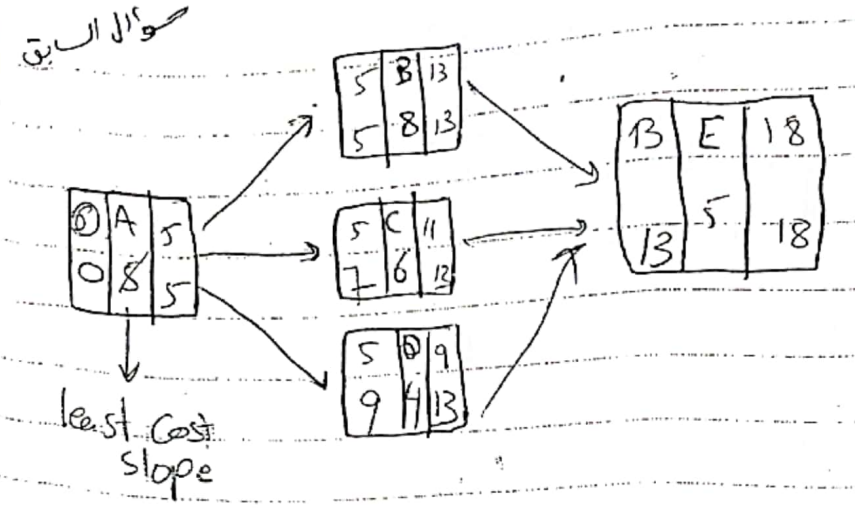
18 × 500 = 9,000

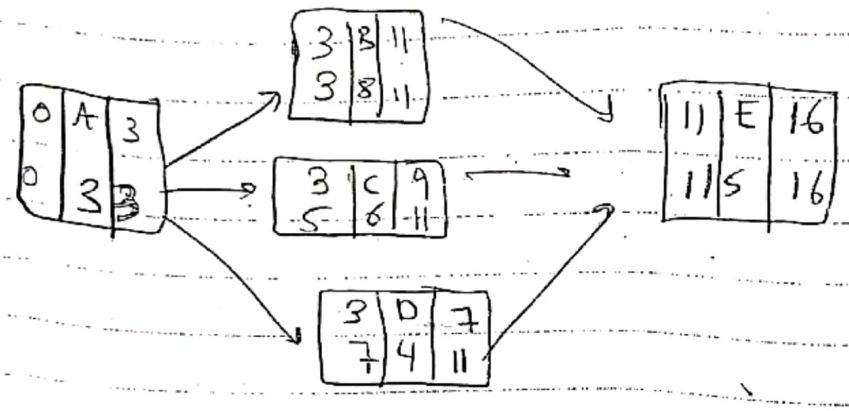
Saving D > Increase in Direct ×

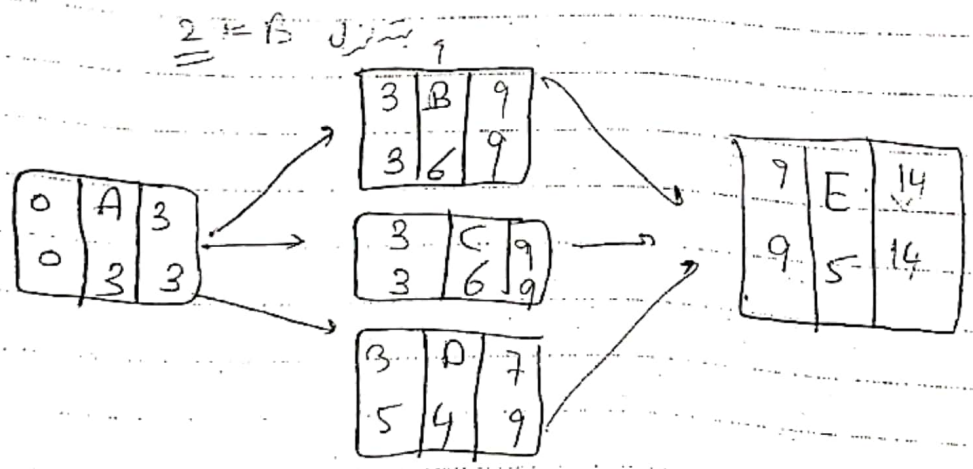
$$\text{Cost slope} = \frac{\text{C.D.C} - \text{N.D.C}}{\text{N.D.C}}$$

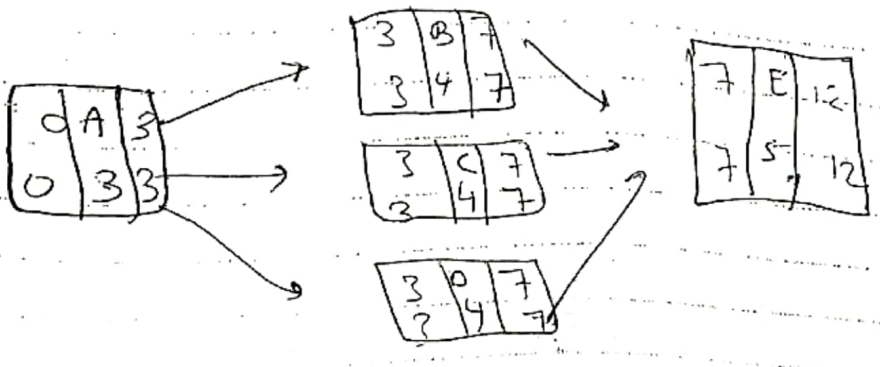
Saving indirect > increase Direct

سوال السابق

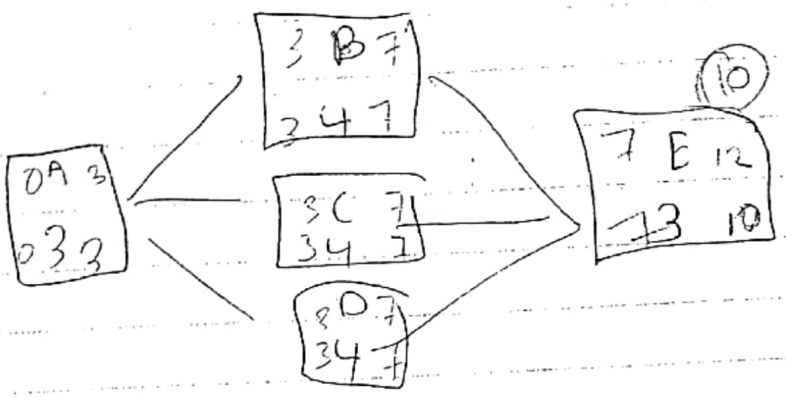




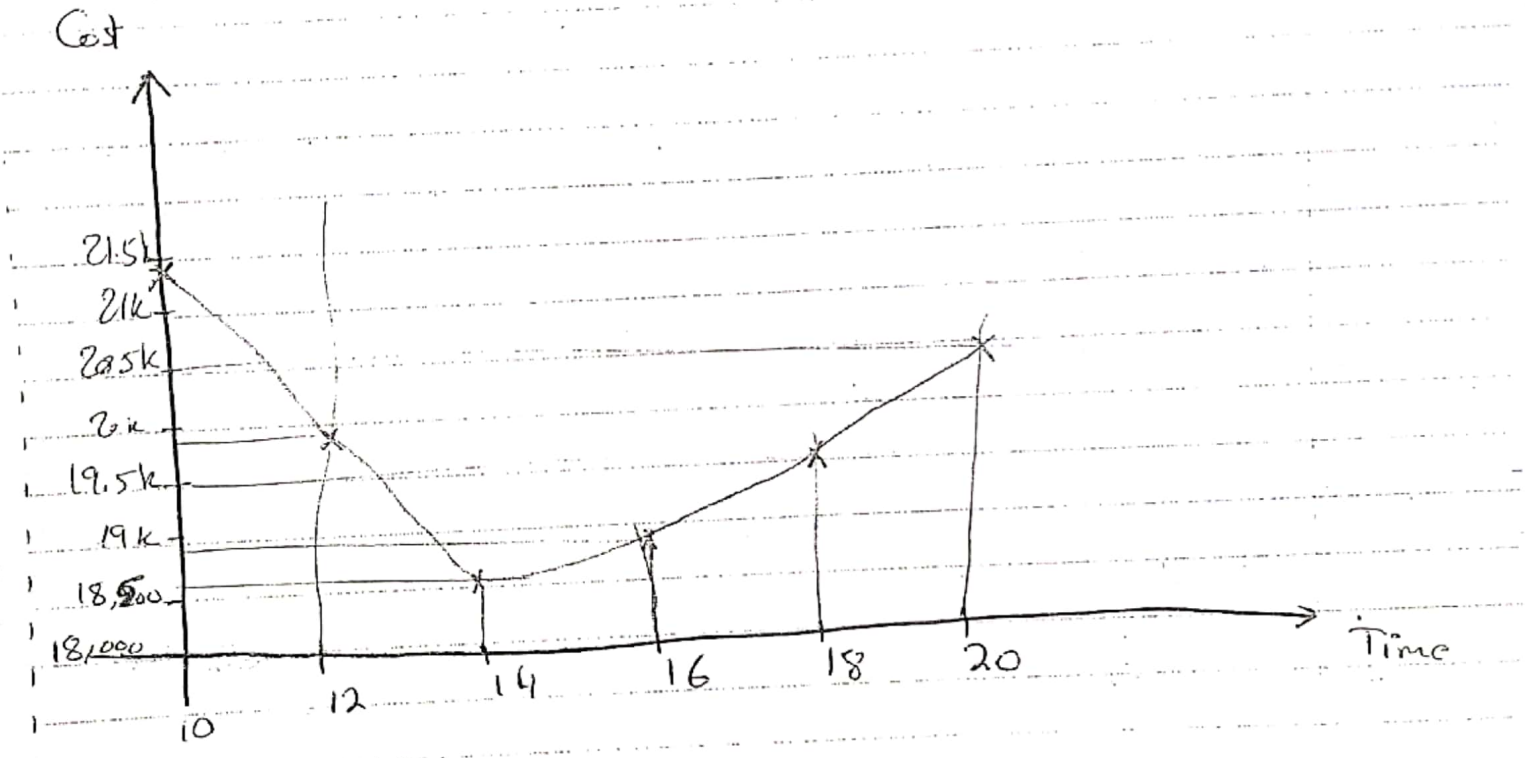


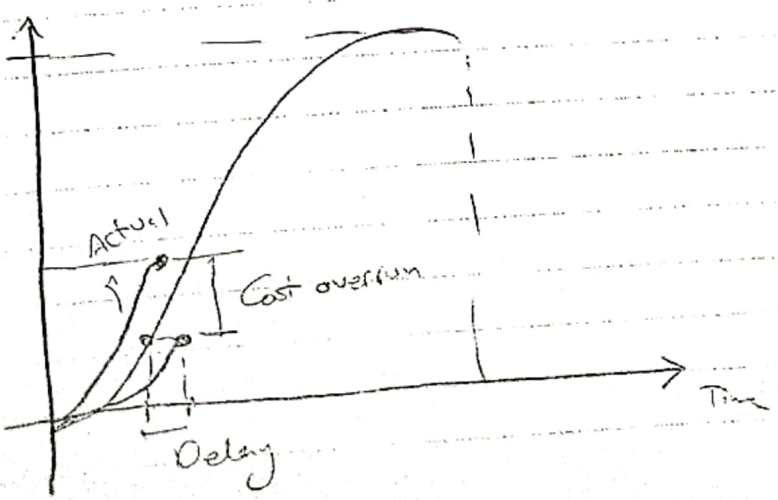


Scanned with CamScanner



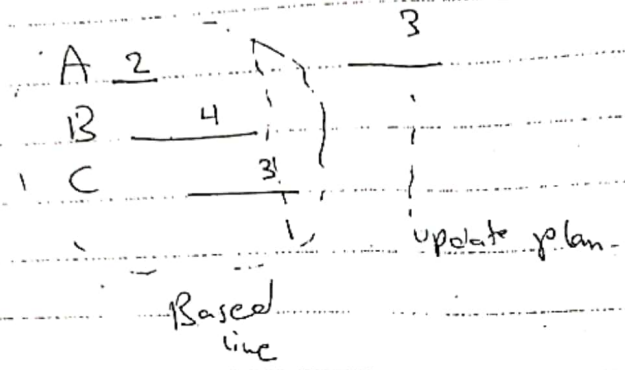
Crash = 10





Lecture 18:-

planning → Base line



* Calculate activities percent Complete

① Unit Complete

% Compl. = Units Comp. / total units

② Pamonth

10,000$ → Forcast 12,000

↓

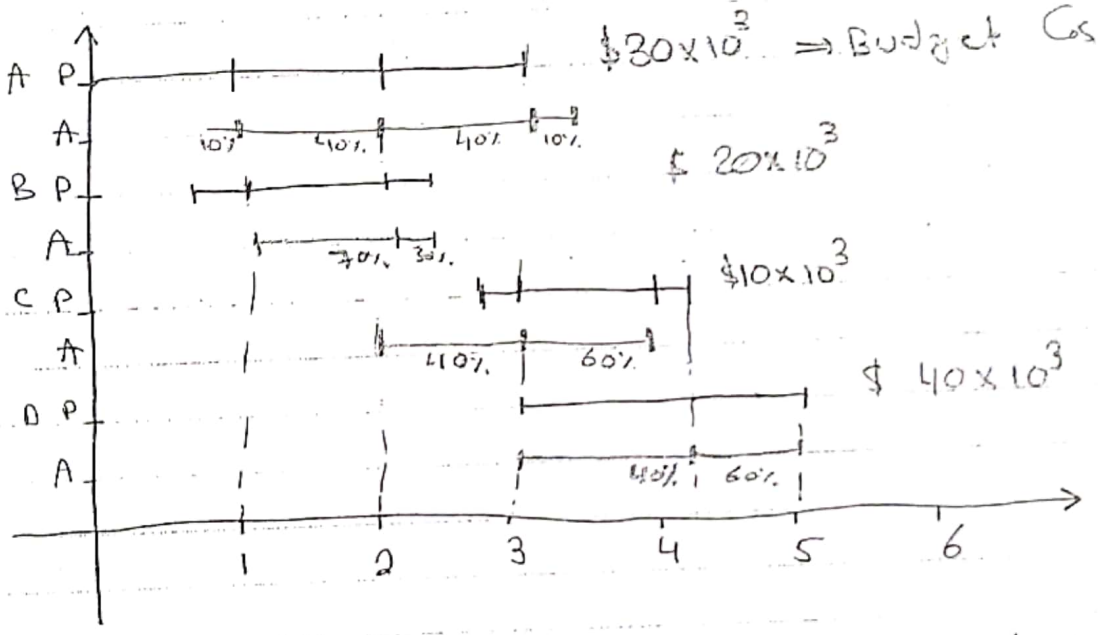
3,0000 / 12,000 =

% Complete = Actual Cost / Forcast at Completion.

Example:- A structural steel with a total weight of 520 tons.

$\Rightarrow$ Risk Fund $\Rightarrow$ $\left(\frac{100}{200}\right) \times 0.02 \times 520 = 10.4$ tons

Example: The planned versus actual bar Charts.



① Calculate the planned VS. actual precent Complete

Task	Budget	Weight	Cumulative % Complete at end of week #				
			1	2	3	4	5
A	$ 30k	30%	P 0.333	0.666	1	1	1
			A 0.4	0.5	0.9	1	1
B	$ 20k	20%	P 0.25	0.75	1	1	1
			A –	0.7	1	1	1
C	$ 10k	10%	P –	–	0.25	0.75	1
			A –	–	0.4	1	1
D	$ 40k	40%	P –	–	–	0.5	1
			A –	–	–	0.4	1
	$ 100k						

- Project percent Complete at any date

3)

$$= \sum_{i=1}^{n} \text{Cumulative \% Complete to date}_i \times \text{weight}_i$$

where i = Activity no, 1, 2, 3, - -, n

* Actual project percent % at the end of W no.2

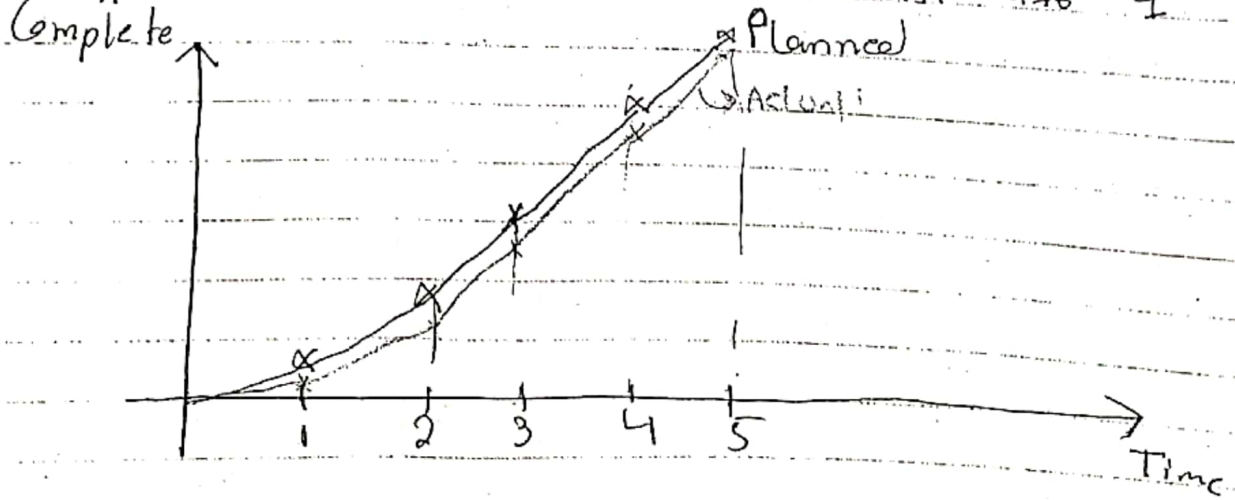
$$\% 2 = 0.5 \times 0.3_A + 0.75 \times 0.2_B + 0 \times 0.1_C + 0 \times 0.4_D$$

$$= 0.29 = \boxed{29\%}$$

* ⇒ planned % at the end of W no.2 = $0.666 \times 0.3 + 0.75 \times 0.2 + 0 + 0 = 0.35 = 35\%$

$$\Rightarrow \boxed{\text{Delay} = 6\%}$$

project % Complete	1	2	3	4	5	
P	0.15	0.35	0.525	0.775	1	(BCWS)
A	0.03	0.29	0.51	0.76	1	



Budget Cost of work performance

③ earned Value ⇒ (Budget of Actual Work) (BCWP)

= Actual % Complete × Budget

$= \sum_{i=1}^{n}$ Actual % Complete$_i$ × Budget$_i$

* for the second period فقط الثاني

up to the second Period

For the 2nd period = 0.4 × 30,000 + 0.7 × 20,000

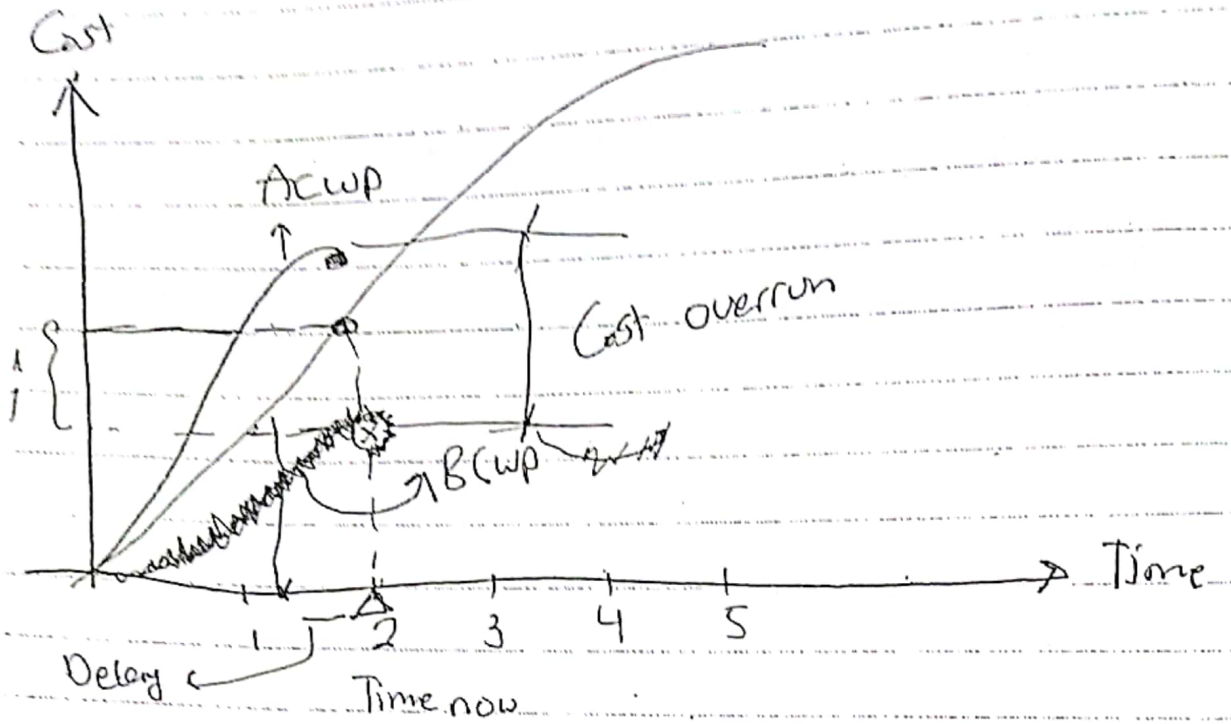
= $ 26,000

ACWP − BCWP = ⊖ Saving

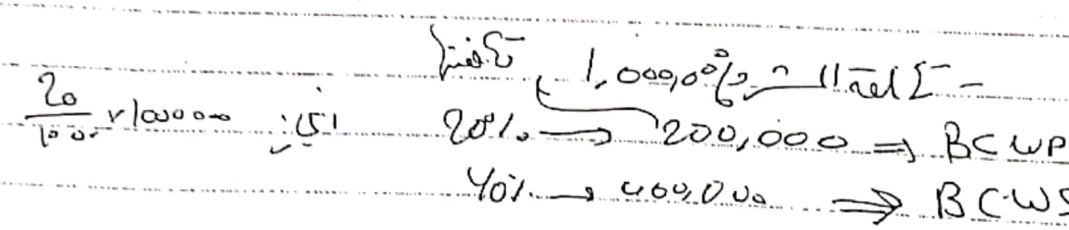
⊕ Cost overrun

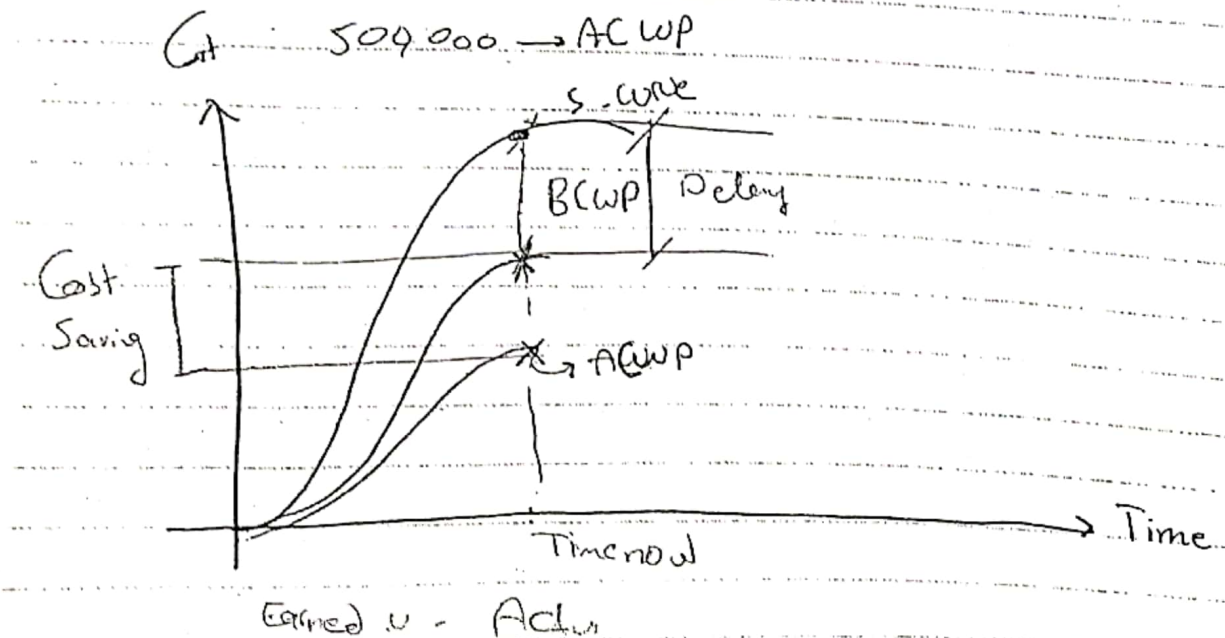
ACWP من الفواتير

(0.29)(−0.03)(100,000) = 26,000 $



E.V = % Completex Budget





Earned V - Actu

C.V = BCWP - ACWP = (+) Saving

= BCWP - BCWS → (+) Scheduled advantage → save time
(-)

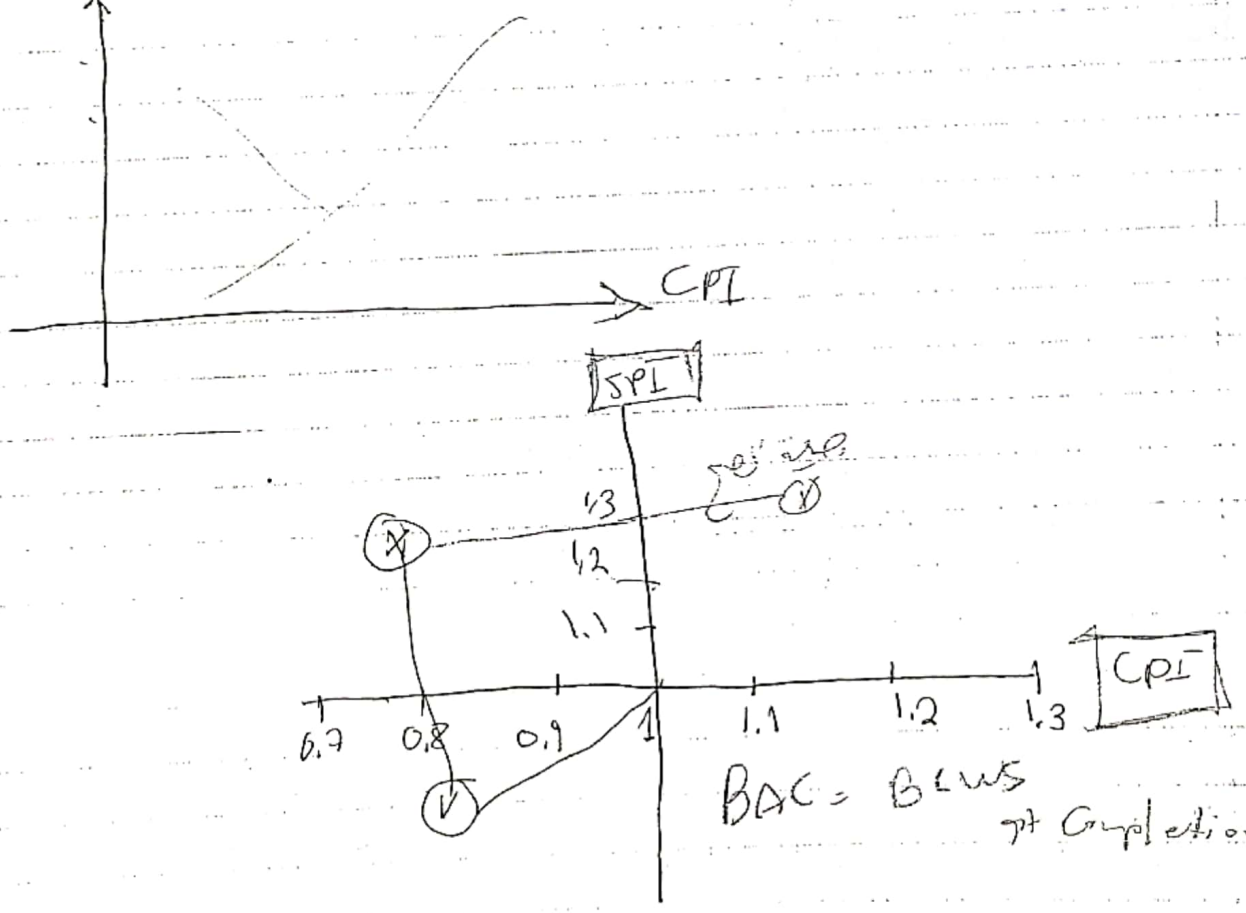
CPI: "Cost performance Index" = $\frac{BCWP}{ACWP}$ > 1

< 1 → Cost overrun

SPI = $\frac{BCWP}{BCWS}$ > 1 → schedule Adv.

< 1 → Delay

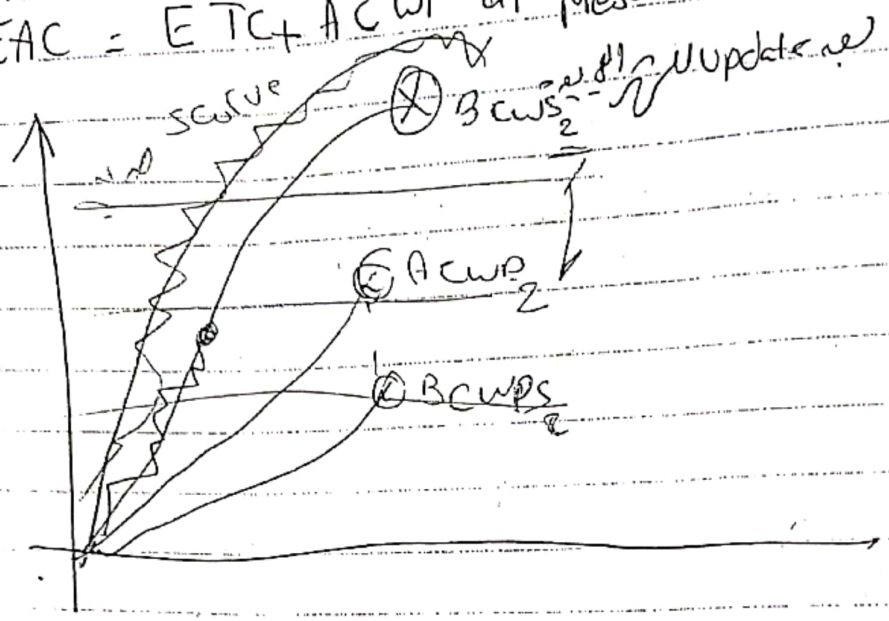
SPI: Scheduled Performance Index



BAC = BCWS at Completion

ETC = $\frac{BCWS \text{ at Completion} - BCWP \text{ at present}}{CPI}$

EAC = ETC + ACWP at present

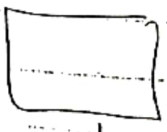


$$ETC = \frac{BCWS_2 - BCWP_2}{CPI_2}$$

$$EAC = ETC + ACWP_2$$

Examples:-

$$ETC = \frac{147,500 - 7600}{7600 / 7700} =$$



+

7706

Ch4 → 2, 4, 5

Ch5 → 2, 4

Ch7 → 7, 49, 5, 69, 89, 99

Ch8 → 4, 6, 7, 8, 9

Ch10 → 2, 5, 6, 7

Ch11 → 2, 4, 5, 6, 7