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## Selection Between Alternatives – إختيار البدائل

**الطرق الأساسية للقيام بالدراسات الإقتصادية تشمل تحليل عناصر إستثمار المال إضافة إلى الكلف المنتظمة و غير المنتظمة و مقارنتها بالعائدات المستحصلة من تشغيل المشروع.**

**أربع طرق للمقارنة بين بدائل الإستثمار:**

**1- Internal Rate of Return (I.R.R)** **طريقة معدل العائد الداخلي**

**2- Annual Worth (A.W)** **طريقة القيم السنوية المستردة**

**3- Present Worth (P.W)** **طريقة القيمة الحالية**

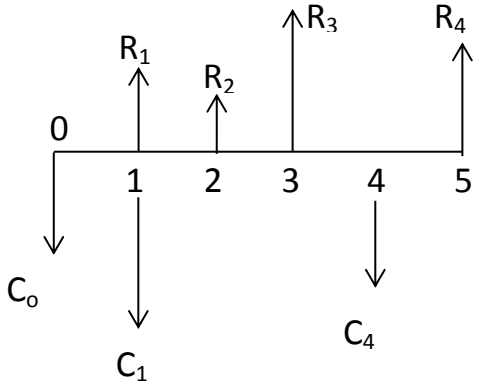
**4- Explicate Reinvestment Rate (E.R.R)** **طريقة معدل العائد الإستثماري النقدي**

## ❖ *Internal Rate of Return (I.R.R)*

**تستخدم هذه الطريقة لإيجاد معدل العائد المتوقع (i)**

$$\text{Present Value (P)} = F\,(1+i)^{-n}$$

$$\sum fy = 0$$




Present:

$$-C_o - C_1\,(1+i)^{-1} + R_1\,(1+i)^{-1} - C_2\,(1+i)^{-2} + R_2\,(1+i)^{-2} + R_3\,(1+i)^{-3} - C_4\,(1+i)^{-4} + R_5\,(1+i)^{-5} = 0$$

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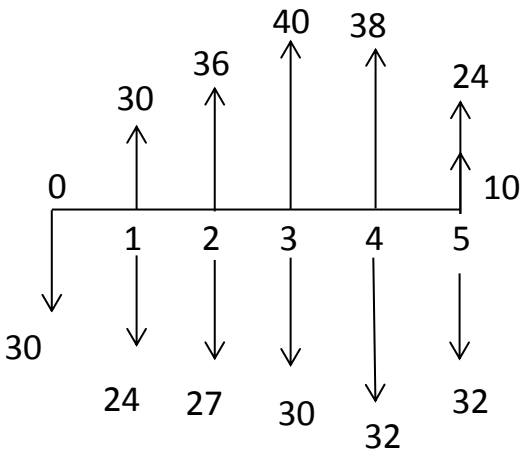
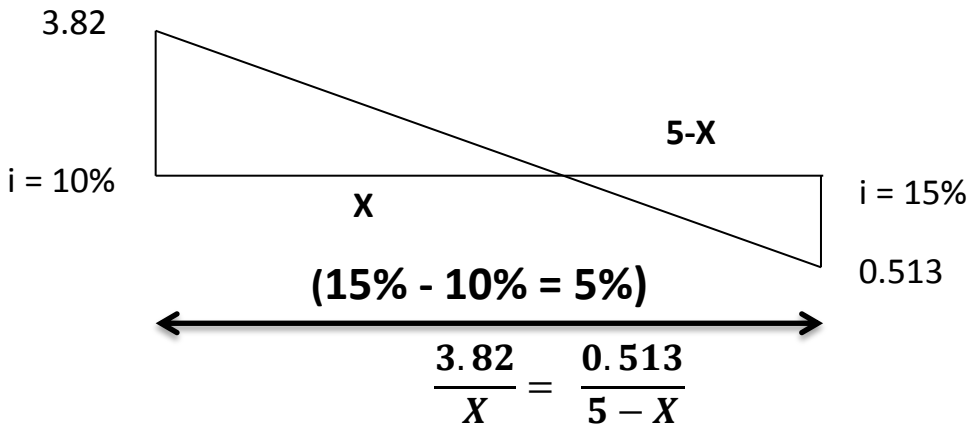
**Example-1/ Find I.R.R for the cash flow shown below:**




| Year | Revenue (R) | Cost (C) | Net Cash flow | i=10% Present Worth factor | Present Worth of Net Cash flow (N.C.F) i=10% | i=15% Present Worth factor | Present Worth of Net Cash flow (N.C.F) i=15% |
|---|---|---|---|---|---|---|---|
| 0 | ---- | -30 | -30 | 1 | -30 | 1 | -30 |
| 1 | 30 | -24 | 6 | 0.909 | 5.455 | 0.8696 | 5.28 |
| 2 | 36 | -27 | 9 | 0.8264 | 7.438 | 0.7561 | 6.805 |
| 3 | 40 | -30 | 10 | 0.7514 | 7.512 | 0.6575 | 6.575 |
| 4 | 38 | -32 | 6 | 0.6832 | 4.098 | 0.5718 | 3.431 |
| 5 | 24 | -19 | 5 | 0.6209 | 3.105 | 0.4972 | 2.486 |
| 5 | 10 | ---- | 10 | 0.6209 | 6.209 | 0.4972 | 4.972 |
| | | | | | ∑ = 3.82 | | ∑ = -0.513 |




$$\frac{3.82}{X} = \frac{0.513}{5 - X}$$

**X = 4.4%**

**So, IRR = 10% + 4.4% = 14.4%**

**المردود السنوي بنسبة 14.4% مقبول**

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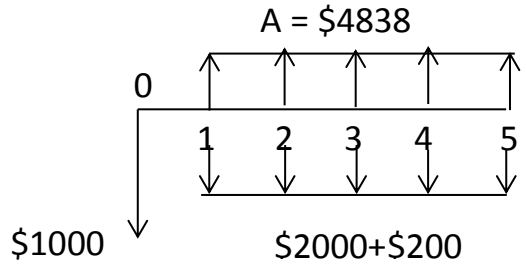
**Example-2/**

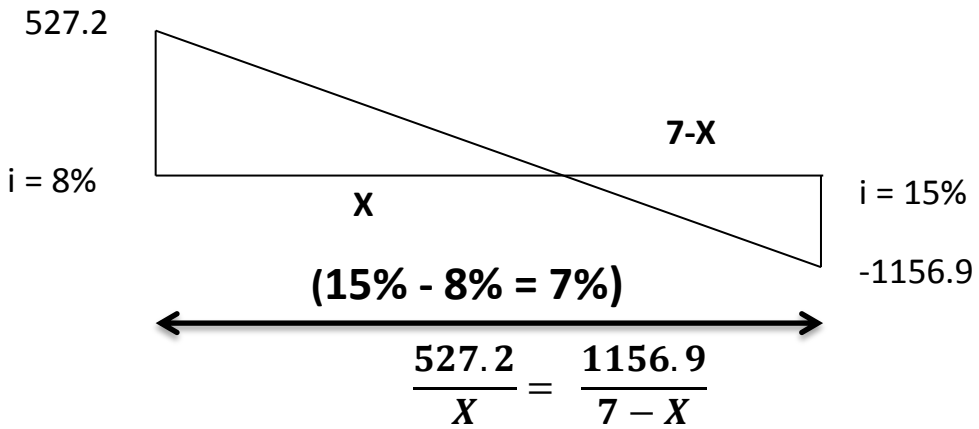
**عُرض على شخص إستثمار مبلغ 1000 دولار في مشروع ينجز في خمس سنوات، الإيراد السنوي المتوقع للمشروع مقداره 4838 دولار، المصاريف السنوية للتشغيل و الصيانة مقدارها 2000 دولار و مقدار الضريبة السنوية 200 دولار، صاحب رأس المال يقبل بالعمل على المشروع إذغ كان العائد السنوي 10%.**

**ما مقدار العائد السنوي الفعلي الذي يحققه هذا المشروع ؟**

**Solution:**




| Year | Revenue (R) | Cost (C) | Net Cash flow | i=8% Present Worth factor | Present Worth of Net Cash flow (N.C.F) i=8% | i=15% Present Worth factor | Present Worth of Net Cash flow (N.C.F) i=15% |
|---|---|---|---|---|---|---|---|
| 0 | ---- | -10000 | -10000 | 1 | -10000 | 1 | -10000 |
| 1 | 4838 | -2200 | 2638 | 0.9259 | 2442.5 | 0.8696 | 2294 |
| 2 | 4838 | -2200 | 2638 | 0.8573 | 2261.6 | 0.7561 | 1994.6 |
| 3 | 4838 | -2200 | 2638 | 0.7918 | 2088.8 | 0.6575 | 1734.5 |
| 4 | 4838 | -2200 | 2638 | 0.735 | 1938.9 | 0.5718 | 1508.4 |
| 5 | 4838 | -2200 | 2638 | 0.6806 | 1795.4 | 0.4972 | 1311.6 |
| الناتج موجب، لذا نزيد نسبة الفائدة | | | | | ∑ =527.2 | | ∑ = -1156.9 |




$$\frac{527.2}{X} = \frac{1156.9}{7 - X}$$

**X = 2.2%**

**So, IRR = 8% + 2.2% = 10.2%**

**المردود السنوي بنسبة 10.2% مقبول لكونة أكثر من 10%**

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**طريقة أخرى لحل السؤال أعلاه: *<u>بإستخدام الجداول</u>***

**Assume: i = 5%**

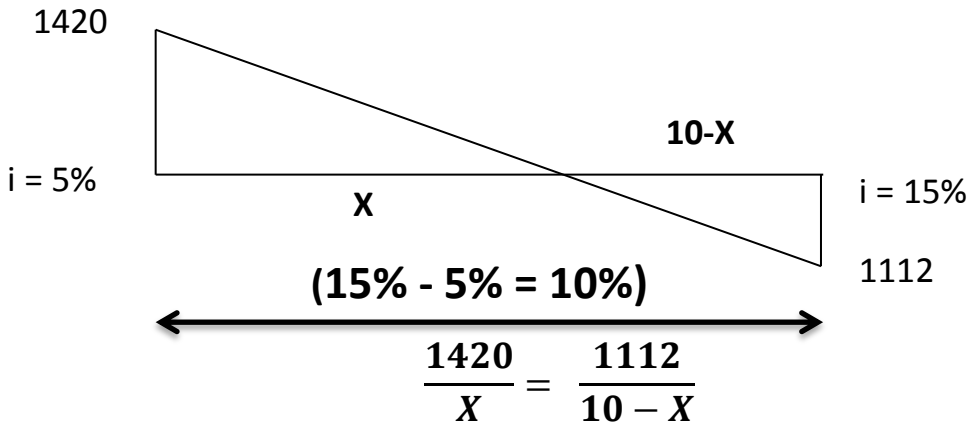
**$\sum fy = 0$**

**-C +R = 0**

$$-10000 + (4838 - 2200)\left[\frac{(1+0.05)^5 - 1}{(1+0.05)^5 \cdot 0.05}\right] = +1420$$

**Assume: i = 15%**

$$-10000 + (4838 - 2200)\left[\frac{(1+0.05)^5 - 1}{(1+0.05)^5 \cdot 0.05}\right] = -1112$$




$$\frac{1420}{X} = \frac{1112}{10 - X}$$

**X = 5.5%**

**So, IRR = 5% + 5.5% = 10.5%**

**المردود السنوي بنسبة 10.5% مقبول لكونة أكثر من 10%**

**Example-3/ A firm is considering three mutually exclusive alternatives as part of a production improvement program. The alternatives are:**

| Alternative | A | B | C |
|---|---|---|---|
| Installation Cost (U) | 18,000 | 27,000 | 19,000 |
| Uniform Annual Benefit (U) | 3,665 | 4,540 | 3,234 |
| Useful life in years | 10 | 14 | 15 |

**Which of the above should be chosen?**

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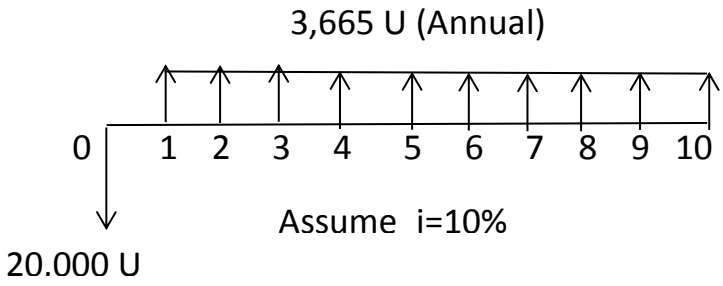
**Solution:**

**Alternative/ A /**

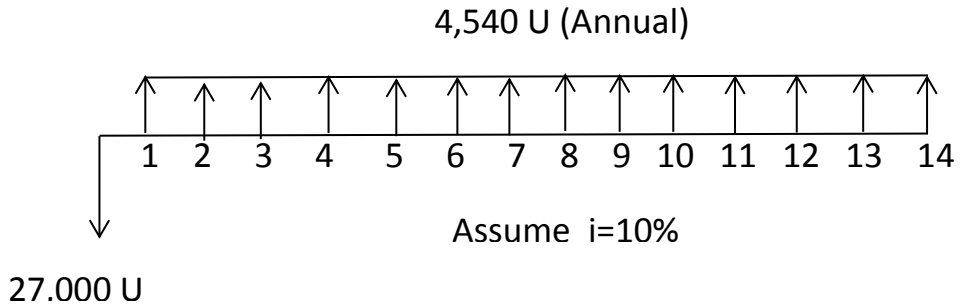



$$P_o \text{ (Revenue)} = 3{,}665 * \left[ \frac{(1+0.1)^{10} - 1}{(1+0.1)^{10} \cdot 0.1} \right] = 22{,}520 \text{ U}$$

**$P_o$ (Cost) = 18,000 U**

**Profit = 22,520 – 18,000 = 4,520 U**

**Alternative / B /**

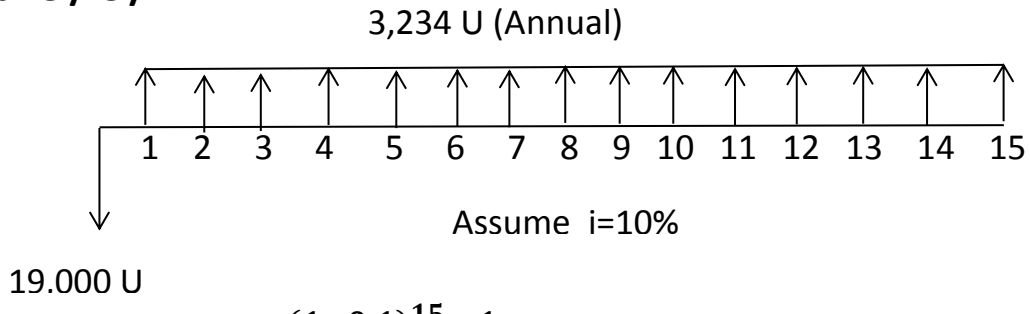



$$P_o \text{ (Revenue)} = 4{,}540 * \left[ \frac{(1+0.1)^{14} - 1}{(1+0.1)^{14} \cdot 0.1} \right] = 33{,}445 \text{ U}$$

**$P_o$ (Cost) = 27,000 U**

**Profit = 33,445 – 27,000 = 6,445 U**

**Alternative / C /**




$$P_o \text{ (Revenue)} = 3{,}234 * \left[ \frac{(1+0.1)^{15} - 1}{(1+0.1)^{15} \cdot 0.1} \right] = 24{,}598 \text{ U}$$

**$P_o$ (Cost) = 19,000 U**

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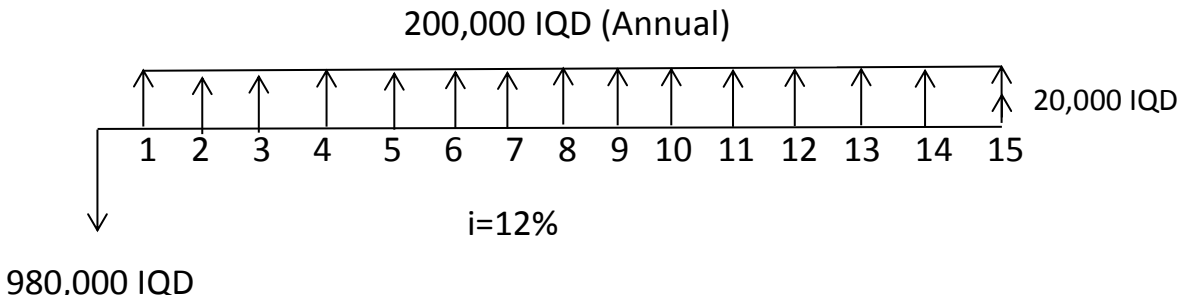
**Profit = 24,598 – 19,000 = 5,598 U**

**((Alternative / B / should be chosen, due to its high profit))**

**Example-4/ A machine costs (980,000 IQD) to purchase and it will provide (200,000 IQD) a year as benefits. The company plans to use the machine for 15 years, then it will sell this machine for (20,000 IQD). The Internal Rate is 12%. Should the company buy this machine?**

**Solution:**




$P_o$**(Revenue) = 200,000 * [** $\frac{(1+0.12)^{15}-1}{(1+0.12)^{15} \cdot 0.12}$ **] + 20,000 (1.12)$^{-15}$ = 1,365,827 IQD**

**$P_o$ (Cost) = 980,000 IQD**

**Profit = 1,365,827 - 980,000 = 385,827 IQD**

**((This machine should be purchased, as it is considered to be profitable))**

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## H.W

**1- Find the internal rate using the method of Internal Rate of Return (IRR) if i = 15%, for the table shown below. If the initial cost is (220,000 U)**

| Cost (U) | 350 | 380 | 400 | 500 | 550 | 470 | 780 | 650 | 690 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|
| Revenue (U) | 0 | 0 | 500 | 1000 | 770 | 450 | 880 | 660 | 890 | 770 |
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**2- Find the profit of the machine, which its details are shown below: ( i = 10%) Useful life (9 years), Initial cost (250,000 U), Revenue (75,000 U each half a year)**

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**3- The maintenance costs for a bridge with an expected 50 years life are estimated to be ($10,000,000) each year for the first 5 years, followed by ($50,000,000) other costs at year 15, and ($75,000,000) at the year 30, if ( i = 10%), what is the annual uniform cost over the entire 50 years?**

**4- A firm is considering three mutually exclusive alternatives as part of a production improvement program. The alternatives are:**

| Alternative | A (i=12%) | B (i=10%) | C (i=15%) |
|---|---|---|---|
| Installation Cost (U) | 200,000 | 270,000 | 190,000 |
| Uniform Annual Benefit (U) | 30,750 | 40,500 | 30,250 |
| Useful life in years | 12 | 14 | 15 |

**Which of the above should be chosen?**