1. a. Compute the (i) net present value and (ii) internal rate of return of the following capital budgeting projects. The firm’s required rate of return is 12 percent.

<table>
<thead>
<tr>
<th>Year</th>
<th>Zeta CF</th>
<th>Omega CF</th>
<th>Σ(PV of CF) Zeta</th>
<th>Σ(PV of CF) Omega</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$(50,000)</td>
<td>$(45,000)</td>
<td>$(50,000.00)</td>
<td>$(45,000.00)</td>
</tr>
<tr>
<td>1</td>
<td>20,000</td>
<td>42,000</td>
<td>17,857.14</td>
<td>37,500.00</td>
</tr>
<tr>
<td>2</td>
<td>15,000</td>
<td>9,000</td>
<td>11,957.91</td>
<td>7,174.74</td>
</tr>
<tr>
<td>3</td>
<td>30,000</td>
<td>1,850</td>
<td>21,353.41</td>
<td>1,316.79</td>
</tr>
</tbody>
</table>

NPV = $1,168.46

IRR = 13.26%

Project Omega:

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV of CF</th>
<th>Σ(PV of CF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$(45,000)</td>
<td>$(45,000.00)</td>
<td>$(45,000.00)</td>
</tr>
<tr>
<td>1</td>
<td>42,000</td>
<td>37,500.00</td>
<td>(7,500.00)</td>
</tr>
<tr>
<td>2</td>
<td>9,000</td>
<td>7,174.74</td>
<td>(325.26)</td>
</tr>
<tr>
<td>3</td>
<td>1,850</td>
<td>1,316.79</td>
<td>991.54</td>
</tr>
</tbody>
</table>

NPV = $991.54

IRR = 14.03%

Following is the computation of the present values of the annual cash flows and the NPV for Project Zeta using the equation method:

\[
\text{NPV} = -50,000 + \frac{20,000}{(1.12)^1} + \frac{15,000}{(1.12)^2} + \frac{30,000}{(1.12)^3}
\]

\[
= -50,000 + 20,000(0.892857) + 15,000(0.797194) + 30,000(0.711780)
\]

\[
= -50,000 + 17,857.14 + 11,957.91 + 21,353.40
\]

\[
= 1,168.45 \text{ (rounding)}
\]

To compute the NPV using a financial calculator, you must use the cash flow register. Enter the cash flows in the following order:

CF0 = −50,000
CF1 = 20,000
CF2 = 15,000
CF3 = 30,000
Then input I = 12
At this point, you have entered the values shown in the above equation. Solving for NPV, you should find \( \text{NPV} = 1,168.46 \). To compute the IRR, enter the cash flows the same as when computing the NPV, but solve for \( \text{IRR} = 13.26\% \).

To compute the NPV and IRR for Project Omega, enter its cash flows in the appropriate order and solve for \( \text{NPV} = $991.54 \) and \( \text{IRR} = 14.03\% \).

b. Which project should be purchased if the projects are independent? Explain why.
All acceptable independent projects can be purchased. Because both projects are acceptable, both projects should be purchased. To determine which independent projects are acceptable for purchase, you can use any of the capital budgeting techniques that are based on time value of money (i.e., NPV, IRR, MIRR, and discounted payback). It doesn’t matter which of these techniques is used, because you only want to know whether a project is acceptable or it is not acceptable. You do not care “how acceptable” the project is, because the firm should purchase all acceptable projects, no matter “how acceptable” they are, to maximize its value.

c. Which project should be purchased if the projects are mutually exclusive? Explain why.
When the projects are mutually exclusive, only one acceptable project can be purchased. Because both projects are acceptable and only one project can be purchased, we must determine which project will add more value to the firm; that is, the project that is more acceptable. Because NPV provides an indication of how the firm’s value will change if a project is purchased, we use NPV to determine which project is more acceptable. The project with the higher NPV will add more value to the firm than the project with the lower NPV. As a result, Project Zeta should be purchased if the projects are mutually exclusive.

d. Given the results of your computation in part a, what should be the discounted payback period for each project? Give your answer in words. Additional computations are not needed to answer this question. Can you tell what each project’s MIRR is?
Because all of the capital budgeting techniques that are based on the time value of money (TVM) must provide the same accept-reject (good-bad) conclusion, we know that when a project is determined to be acceptable using one TVM capital budgeting technique, it will be determined to be acceptable using the others. We know that both projects are acceptable using the NPV and IRR techniques, because NPV > 0 and IRR > 12\% for both projects. Consequently, the results of computing the projects’ discounted payback periods (DPBs) and MIRR will also show that the projects are acceptable. To be acceptable the projects must have \( \text{DPB} < 3 \) and \( \text{MIRR} > 12\% \).

e. Compute the discounted payback period.
Following are the DPBs for the two project:

\[
\text{DPB}_{\text{Zeta}} = 2 + \frac{20,184.95}{21,353.41} = 2.95 \text{ years} \quad \text{DPB}_{\text{Omega}} = 2 + \frac{325.26}{1,316.79} = 2.25 \text{ years}
\]
f. Suppose that a different firm also evaluates Project Zeta. If its required rate of return is 15 percent, should this firm purchase the project? No computations are needed to answer this question.

Because the new firm’s required rate of return, \( r = 15\% \), is less than Project Zeta’s IRR = 13.26\%, the project is not acceptable, and thus it should not be purchased. If you compute the project’s NPV using \( r = 15\% \), you will find \( \text{NPV} = $(1,541.05) \).