1. (i) (a) $\text{NPV of A @ 10\%} = $137.24$
$\text{NPV of B @ 10\%} = $216.94$

(b) $\text{IRR of A} = 15.24\% \text{ p.a.}$
$\text{IRR of B} = 14.65\% \text{ p.a.}$

(c) Under take project B: both projects have the same $K_0 = $10,000, and a + 10\% p.a. project B has the larger NPV even though its IRR is lower. Moreover, both projects have the same life and are mutually exclusive.

(ii) (a) The NPVs of the three projects are $600, $450, and $300, respectively. If only one project is chosen, it should be project A, leaving nothing in the budget, with an NPV of $600.

(b) But if more than one project can be undertaken (not mutually exclusive), then projects B and C should be, also exhausting the budget, but with a combined NPV of $750. In general, $\text{NPV}/K_0$ gives $0.25, 0.35, 0.27$, as is seen below.

NPV is the area under the curves, maximised with B & C for $K_0 = $2400.
2(a) For the 50 skilled workers diverted from elsewhere, the shadow cost is their value to their previous employer (viz. $500/week. It is a social cost, because their previous employer must now find replacements (either labour or machines, etc.) For the 150 who have been employed driving cabs (a second-best choice for them) etc., the cost is the value to them (their take-home pay). At the margin, this is $500/1.20 = $416/w, but for some workers it's even lower. The shadow-wage is then a weighted average of the two:

\[ 0.25 \times 500 + 0.75 \times 416 \]

\[ \leq 437 \text{/week} \]

To be more accurate, we'd need to know the previous 'take-home', after-tax wages of the 150 workers.

(b) From the handout on the solution to the first spreadsheet exercise, 

\[ \text{NBIR} = \frac{\Sigma (B_t - OC_t)}{(1+i)^t} \]

\[ \geq \frac{\Sigma OC_t}{(1+i)^t} \]

is the ratio of the present value of the project's benefits minus its operating costs OC to the present value of its investment cost.

If calculates the net operating benefits per unit of investment. But it is unsuitable for choosing mutually exclusive projects.
but if separates operating costs from investment costs — operating costs might be financed from operating revenues.

- NBIR is better than B/C because it ranks projects by return per unit inflow, and so can be used with capital budgeting to obtain the mix of (non-exclusive) projects which maximises NPV.

(c) The table from p. 20 of the DfF Handbook shows how to allow for taxes and subsidies on project inputs and outputs (see Q3.16). In particular, there is a distinction between incremental or displaced inputs and outputs.

Take labour as an input (Q46): when there is no displacement from existing employers (no change in price, because the supply elasticity of labour is infinite and the labour supply curve horizontal), then the shadow wage should be

\[ W = \text{market wage} - \text{tax} \quad \text{(tax exclusive)} \]

because this take-home pay is what the worker receives, that is, value of other opportunities forgone, at the margin.

When there is displacement (the project bids up the wage rate, since labour supply is not perfectly elastic or horizontal), then the cost is

\[ \text{the value of these displaced workers to their previous employer } = \text{the unit cost } \times \text{the wage paid (including the tax)} \]
(3) The $500k is clearly a cost: the value of the increased resources of the police etc. Since it cannot be used elsewhere now, it is an opportunity cost.

What of the $1m of stolen goods? This is a transfer (yes, an involuntary, illegal transfer, but still something for nothing).

Who loses with the increased policy (the owner of the goods win, since their goods are not stolen?).

Well, after selling to the fences, the thieves would have received $600k so they lose. And the fences, newly bought "hot" goods have a net value of $400k, which they lose with the increased policy.

Ignored these transfers?

So far: our cost = $500k.

Need to consider other benefits of the increased policy: lower private security payments, lower levels of anxiety, loss of sentimental goods (of no value to the thief, but often irreplaceable for their owner). These benefits are not captured in the $1m book value.
3.  

Save \{ \begin{align*}
6 \text{ min} & \cdot \$4/\text{hr} \\
2 \text{ hr} & \cdot \$1/\text{l}
\end{align*} \}

\begin{align*}
\text{effective cost per trip}
\end{align*}

\begin{align*}
\text{A} & \quad \text{B}
\end{align*}

\begin{align*}
\text{100 \text{ hr}} & \quad \text{150 \text{ hr}}
\text{trips/year}
\end{align*}

(a) Including fuel taxes:

Savings to existing drivers (area A)
\begin{align*}
\text{time} & = \frac{1}{2} \times 100,000 \times \frac{1}{12} \times 4 = 83,333 \text{ yr/yr} \\
\text{fuel} & = \frac{1}{2} \times 100,000 \times 2 = 50,000 \text{ yr/yr} \\
\text{Savings to new drivers (area B)}
\end{align*}

\begin{align*}
\text{time} & = \frac{1}{2} \times 50,000 \times \frac{1}{12} \times 4 = 50,000 \text{ yr/yr} \\
\text{fuel} & = \frac{1}{2} \times 50,000 \times 2 = 50,000 \text{ yr/yr}
\end{align*}

\text{But for existing drivers, 80\% of the fuel savings is a transfer: subtract $160,000/yr.}

\therefore \text{Annual savings} = $140,000/yr = \Delta CS

\text{At 10\% p.a.} \quad \text{capital value of $1.4m}
\text{Cost of construction} = $1.2m \quad \text{NPV > 0 GO!}

(b) What is the lifetime of the road?

What are the maintenance and operating costs?

What is the level of unemployment among truckers?

What is the tax level for truckers? (payroll)

What is the reduction in accidents?

What is the level of externalities = drivers?

\text{etc.}
4. (a) IRR = discount rate → NPV = 0
NPV is scale-dependent; additive, unique and used for capital budgeting.
Simple to calculate.
IRR is scale-independent, non-unique.

(b) When K (the supply elasticity of labour) is infinite,
then the supply curve S
is horizontal, and no
diverted labour, only
incremental.
\[ s' \]
\[ s \]
\[ \text{inc: } sh. w = \text{m. w. - tax} \]
\[ \text{div: } sh. w = \text{m. w.} \]

(c) For involuntarily unemployed workers, the
(wage - tax) overstates the value of leisure.
they would work, but can't find jobs.
- The shadow wage < market wage - tax.
(d) Bowen double country (multiplier, P.E.E.).

The purpose of Interlingua is to become profitable for its shareholders (see Pa), from a social point of view (CPA), we are concerned with increased efficiency especially from the uses to which its graduates put their new language skills, to increase Australia’s value added.

To the extent that these benefits accrue to the graduates via higher salaries, Interlingua could rational its fees.

If the (positive) externalities are beyond Interlingua and its graduates, look at the activity and profitability of the firms who employ the graduates and the levels of inbound tourism from the countries whose languages are taught (see later).

(e) If PA < 0 but NPV > 0, then from PIC Interlingua is a good thing, but it won’t operate at a loss.

The government could assist (through subsidies or tax break), but any such taxes will distort the market making money → a Dead Weight Loss or inefficiency. OK, so long as DWL < NPV.