Homework 1

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Operations Break-Even Examples using software

Formula for calculating break even point

```
BEP_Unit = FixedCost / (SellingPrice - VariableCost)
ContributionMargin = (TotalRevenue - VariableCosts) / TotalRevenue
BEP_Dollar = FixedCost / ContributionMargin
BEP_Dollar = BEP_Unit * SellingPrice
```

BEP Functions

```r
# BEP Unit
bep_unit <- function(fixed_cost, selling_price, variable_cost) {
  paste0('Break Even Point Units: ',
         scales::comma(
           fixed_cost / (selling_price - variable_cost), accuracy = .01
         )
  )
}
# BEP Revenue
bep_rev <- function(fixed_cost, selling_price='', variable_cost='', cm = NULL) {

  if (is.null(cm)) {
    cm <- ((selling_price - variable_cost) / selling_price)
  }

  paste0('Break Even Point: ',
         scales::dollar(
           fixed_cost / cm , accuracy = .01
         )
  )
}
```

Problem 1

```
1. The Beta Manufacturing Company produces
stepladders that sell for $27 each. The production
capacity is limited to 48,000 units per year. Fixed
costs are $50,000 and variable costs are $12 per
```

```
item. Compute the break even point in number of
stepladders. How many items must be sold to
provide a profit of $20,000 What is allocation of
fixed costs per stepladder at 75 percent capacity?
```

```
price = 27
capacity = 48000
variable_cost_unit = 12
total_fixed_cost = 50000
expected_profit = 20000
```

Answer 1

Compute the break even point in number of stepladders:

> Break Even Point Units: 3,333.33

How many items must be sold to provide a profit of $20,000:

> Break Even Point Units: 4,666.67

What is allocation of fixed costs per stepladder at 75 percent capacity?

> $1.39 Fixed cost per unit.

Problem 2

```
2. A firm produces four models of tool sets. The fixed costs are
$42,000 and the other data are as follows:

Model     Qty    Price  Variable Cost     Sales  Revenue
S     4,000     $20   6         $80,000
T     5,000     32    8        $160,000
U     1,000     60    20         $60,000
V     2,000     50    18         $100,000

- Total $400,000

Determine the break even in dollars

What is the Margin of Safety if Sales =$75,000?
```

```
prob_2 <- tibble::tribble(
  ~Model, ~Qty, ~Price, ~Variable_Cost, ~Sales_Revenue,
  'S', 4000, 20, 6, 80000,
  'T', 5000, 32, 8, 160000,
  'U', 1000, 60, 20, 60000,
  'V', 2000, 50, 18, 100000
)
fixed_costs = 42000
total_rev = 400000
knitr::kable(prob_2)
```

Model	Qty	Price	Variable_Cost	Sales_Revenue
S	4000	20	6	80000
T	5000	32	8	160000
U	1000	60	20	60000
V	2000	50	18	100000

```
cm_2 <- prob_2 %>%
  mutate(
    cm = (Price - Variable_Cost) / Price,
    relative_sales = Sales_Revenue / total_rev,
    total = cm * relative_sales
  ) %>%
  summarise(cm = sum(total))
```

Answer 2: Determine the break even in dollars:

Break Even Point: $60,000.00

What is the Margin of Safety if Sales = $75,000?

$15,000

Problem 3

```
3. The Clutch Engineering Company is proposing to locate
a branch office in one of two West Coast locations, A or B.
These two sites have quite different estimated operating
costs:
                           A        B
Engineering labor cost     $15/hr. $16/
Materials and supplies    2.40/hr. $1.80/
- (tied to engineering hours)
Variable overhead         5.50/hr. 4.40/hr.
Total annual fixed cost   $150,000 $190,000
Price to customers.       $30 $30

Consider the hourly costs to be variable costs.

a. Compute the break even for both locations.

b. At what level of output (number of hours) are you in
different to the location?
```

```
prob_3 <- tibble::tibble(
  product = c('a', 'b'),
  v_labor_cost = c(15, 16),
  v_materials = c(2.40,  1.80),
  v_variable_overhead = c(5.50, 4.40),
  total_fixed_cost = c(150000, 190000),
  price = c(30,  30)
```

```
)

knitr::kable(prob_3)
```

product	v_labor_cost	v_materials	v_variable_overhead	total_fixed_cost	price
a	15	2.4	5.5	150000	30
b	16	1.8	4.4	190000	30

```
resp <- prob_3 %>%
  rowwise() %>%
  mutate(variable_costs = sum(across(starts_with('v_'), sum)))
```

Answer 3

> A: Break Even Point Units: 21,126.76
>
> B: Break Even Point Units: 24,358.97

Indifference:

```
150,000 + 22.9x = 190,000 + 22.2x
0.7x = 40,000
```
57,142 hours

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