Homework 1

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Hello world! the following text is in Spanish: Me gusta el diseño gráfico.

1. This is an example using a lot of mathematics an equations. First, we show that we can create a simple equation like this:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \tag{1}$$

And we can refer to it later in the text like this: the equation (1) is an elipse. If we do not want to have it numbered we can say:

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

And you can also embed equations into text for example: $\forall x \in \mathbb{R}$. You can make links to an external website like this: To learn how to use the sumation and integrals you can check the wikibooks in or search for it in `www.google.com`. The last form makes the link use other font.

2. This is an example of an function with cases, like a *pdf*.

$$f(y) = \begin{cases} \frac{1}{25}y & \text{if } 0 \leq y < 5 \\ \frac{2}{25} - \frac{1}{25}y & \text{if } 5 \leq y < 10 \\ 0 & \text{if } y < 0 \text{ or } y > 10 \end{cases} \tag{2}$$

This is an example of automatic sizing parenthesis:

$$P\left(A = 2 \middle| \frac{A^2}{B} > 4\right)$$

And finally, an example of making math in several steps uisng the `align` enviroment. With $*$ in the enviroment you omit the numbers

$$\begin{aligned} P\left(X \leq 3\right) &= \int_0^3 \frac{1}{25} y \, \mathrm{d}y \\ &= \frac{1}{25} \cdot \frac{1}{2} y^2 \Big|_0^3 \\ &= \frac{1}{25}\left(\frac{1}{2}9 - \frac{1}{2}0\right) = \frac{1}{25} \cdot \frac{9}{2} = \frac{9}{50} \approx 0.18 \end{aligned}$$

3. This section shows how to place figures. The most common way is to place a figure centered with his caption.

   But its also possible to have a figure that is composed of several subfigures. Each subfigure with his caption and an extra caption for the whole figure group. And then you can reference them like this: See Figure 2 or refer to subfigure like this: See Sub Figure 2b.

4. This is an example of how to cite a book.: this exercise was taken from [1]. We also show an example of how to put a book in the references without actually citing it. And finally, this is an example of a very nice table: Table 1

5. In this number lets look at how to write an algorith using pseudo code. See the algorithm 1. The while ends in line 7. The information comes from this part of the wikibook and from this post.

   The algorithm enviroment uses all the width of the page. There is a hack to make it fit into a certain width, however use it with caution.

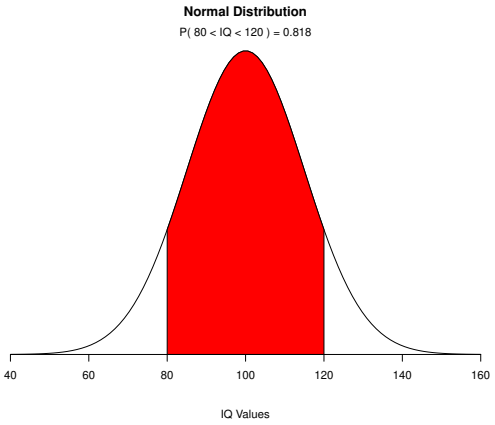
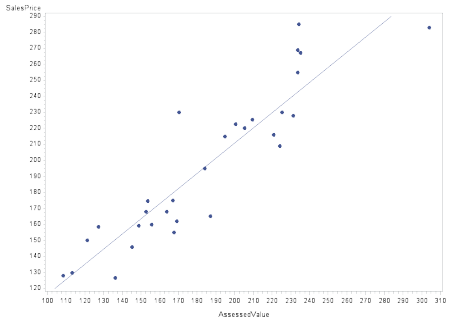
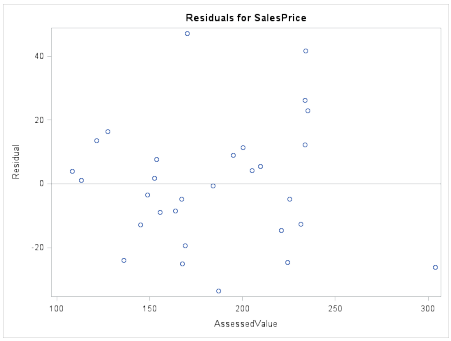


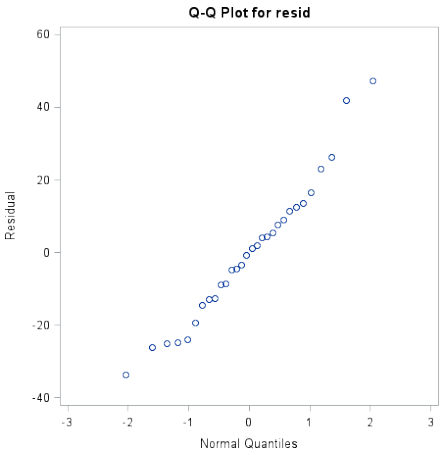
Figure 1: Plot of normal distribution from R scrip.



(a) Scatter plot Assessed value v.s. sales price.



(b) Residuals vs assesed value.



(c) Normal quantile plot of the residuals.

Figure 2: Plots of an imaginary exercise, lets call it X.

Algorithm 1 Euclid's algorithm

```
procedure EUCLID(a, b)                          ▷ The g.c.d. of a and b
    r ← a mod b
    while r ≠ 0 do                              ▷ We have the answer if r = 0
        a ← b
        b ← r
        r ← a mod b
    end while
    return b                                    ▷ gcd = b
end procedure
```

6. Here we show how include surce code using the package minted. We are going to show an example in the C language.

Source	DF	SS	MS	F	P-value
Model	2	0.00318564	0.00159282	7.72	0.0014
Error	42	0.00866760	0.00020637		
Total	44	0.01185324			

Table 1: Anova table for an imaginary exercise

```
int main() {
  printf("hello, world");
  return 0;
}
```

This is another example; this time on the *R language*

```
A <- matrix(c(0.15, 0.01, 0,
              0.14, 0.36, 0.07,
              0.15, 0.13, 0.3), ncol = 3, byrow = TRUE)
I = diag(nrow = nrow(A))

I%*%A
```

This is yet another example of inlined Python code: `print(x**2)` lets see how it looks. Finally, lets try to input another file: See Listing 1. I took a lot of help from here and Overleaf help. We are using the same hack that we used with the algorithm to make the listing fit into the margins.

Listing 1 My buggy implementation of insertion sort. (Do not use)

```
54 void insertion_sort(array<int, N>& input) {
55   for (size_t i = 0; i < N; ++i) {
56     size_t max_key = 0;
57     for (size_t j = 1; j < N - i; ++j) {
58       if (input[j] > input[max_key]) {
59         max_key = j;
60       }
61     }
62     if (max_key != N - i - 1) {
63       auto tmp = input[N - i - 1];
64       input[N - i - 1] = input[max_key];
65       input[max_key] = tmp;
66     }
67   }
68 }
```

References

[1] Jay Devore. *Probability and Statistics for Enginiering and the Sciences*. Ed. by Michelle Juliet. 8th ed. Richard Straton, 2012.

[2] Sheldon M. Ross. *A First Course in Probability*. Ed. by Deirdre Lynch. 9th ed. Pearson, 2012.