# Estimation theory & hypothesis testing

October 20, 2024

[5]:
```
#Q1)

import scipy.stats as stats
mean_pop=60
std_dev=66
n=40
sample_mean=58

error= std_dev/(n**0.5)
z=(sample_mean-mean_pop)/error

probability = stats.norm.cdf(z)
print(f"Required Probability: {probability}")
```

```
Required Probability: 0.4240069369665028
```

[8]:
```
#Q2)

import scipy.stats as stats
avg=310
n=40
std_dev=89
z_critical = 1.96

error=std_dev/(n**0.5)

error_margin = z_critical * error

lower_bound=avg-error_margin
upper_bound=avg+error_margin
print(f"Lower bound: {lower_bound}")
print(f"Upper bound: {upper_bound}")
```

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Lower bound: 282.4186142480114
Upper bound: 337.5813857519886
```

[10]:
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#Q3)
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# Null Hypothesis: The mean waiting time has not changed from 4.5 minutes (H0:
↪mu = 4.5 minutes).
# Alternate Hypothesis: The mean waiting time has changes from 4.5 minutes (h1:
↪mu != 4.5 minutes).

# In this case it will be a two-tailed test.
```

[11]:
```
#Q4)

import scipy.stats as stats
z_stat = 2.00

p_value = 2 * (1-stats.norm.cdf(z_stat)) #Multiplying by two because it is a
↪two tailed test
print(f"p-value: {p_value}")
```

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p-value: 0.04550026389635842
```

[12]:
```
#Q5)

import scipy.stats as stats
sample_mean = 30000
hypothesized_mean = 29000
std_dev = 8000
n = 400

error = std_dev / (n ** 0.5)
z_stat = (sample_mean - hypothesized_mean) / error

p_value = 1 - stats.norm.cdf(z_stat)

z_stat, p_value
```

[12]:
```
(2.5, 0.006209665325776159)
```