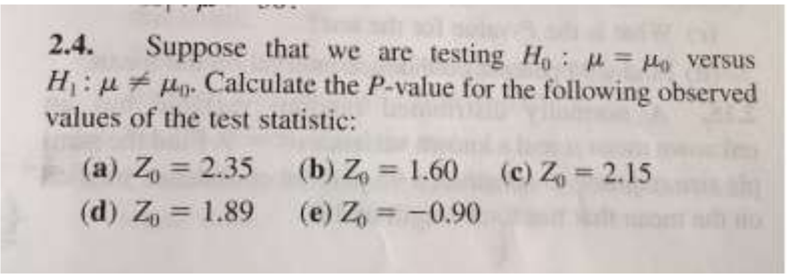
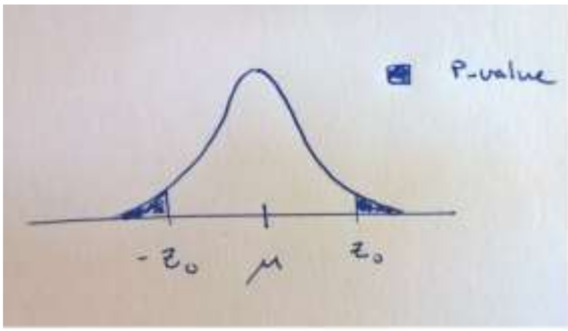
DAE 8ed, Problem 2.4
Given:



2.4. Suppose that we are testing $H_0: \mu = \mu_0$ versus $H_1: \mu \neq \mu_0$. Calculate the *P*-value for the following observed values of the test statistic:

(a) $Z_0 = 2.35$ **(b)** $Z_0 = 1.60$ **(c)** $Z_0 = 2.15$
(d) $Z_0 = 1.89$ **(e)** $Z_0 = -0.90$

Solution:
The Z statistic is from a standard normal distribution N(µ,sigma), where µ=0 and sigma=1. The test is double sided as both values greater or smaller are possible under H1. The P-value is the probability for more extreme cases than Z0 (see figure 01).



The distribution is symmetric around the mean (µ=0), with unit variance (sigma=1) and the P-value can therefore be described as twice the probability of more extreme cases than Z0, P(z>Z0), i.e.

P=2*P(z>Z0)

This probability in turn is derived from the CDF as

P(z>Z0)=1-P(z≤Z0)=1-CDF(Z0)

The CDF of the normal distribution is determined by the error function, which does not have an analytical solution for the 1-D case. Using MATLAB/OCTAVE the following code will determine the P-values.

```
Z0=[2.35, 1.60, 2.15, 1.89, -0.90]'; %Vector cases A-E


P=2*(1-normcdf(abs(Z0),0,1)) %Note the absolute value due to case e being
negative

P =
    0.0188
    0.1096
    0.0316
    0.0588
    0.3681
```

Here the smaller values are more likely under H1.