Assignment 6

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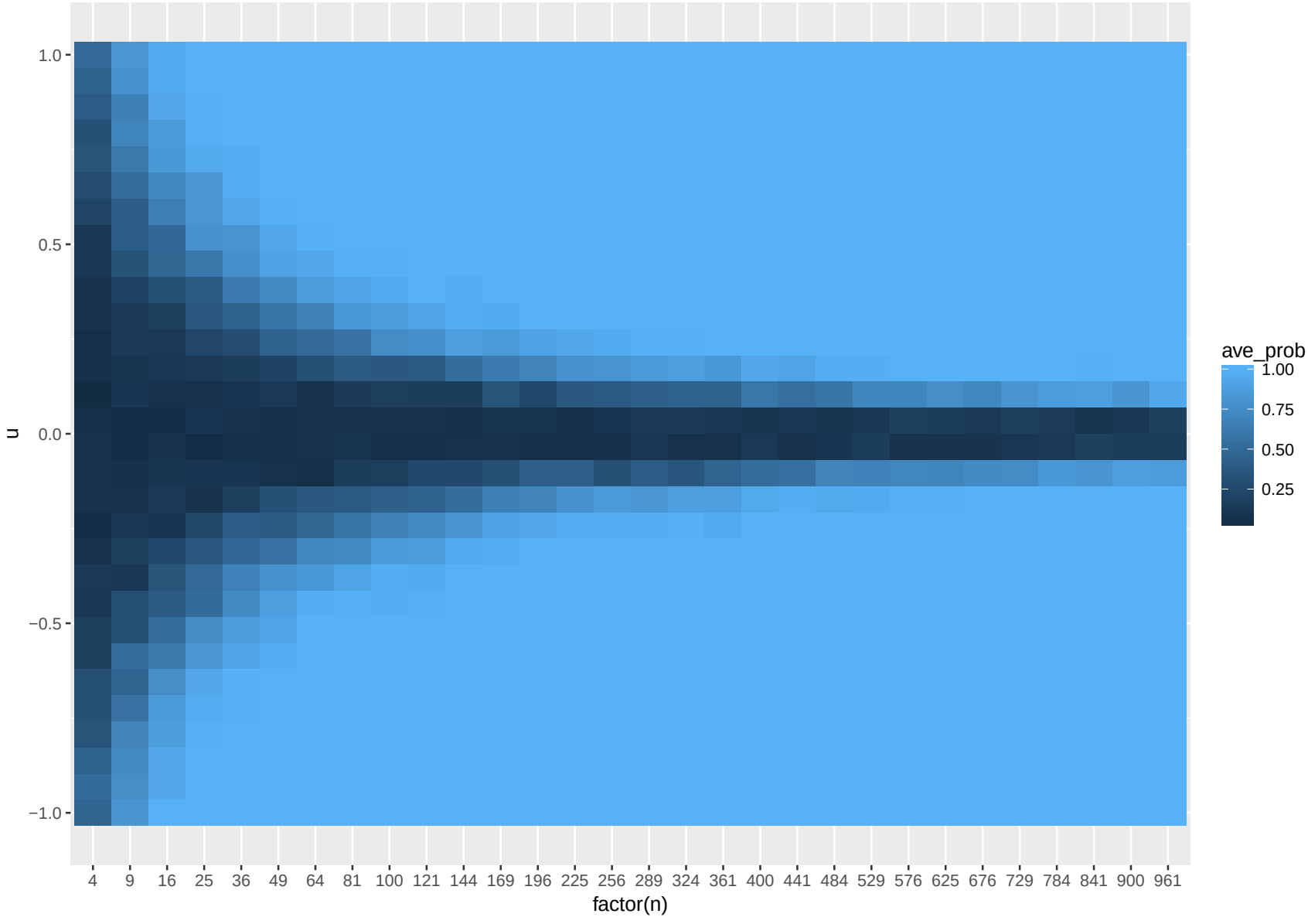
Analytical Results

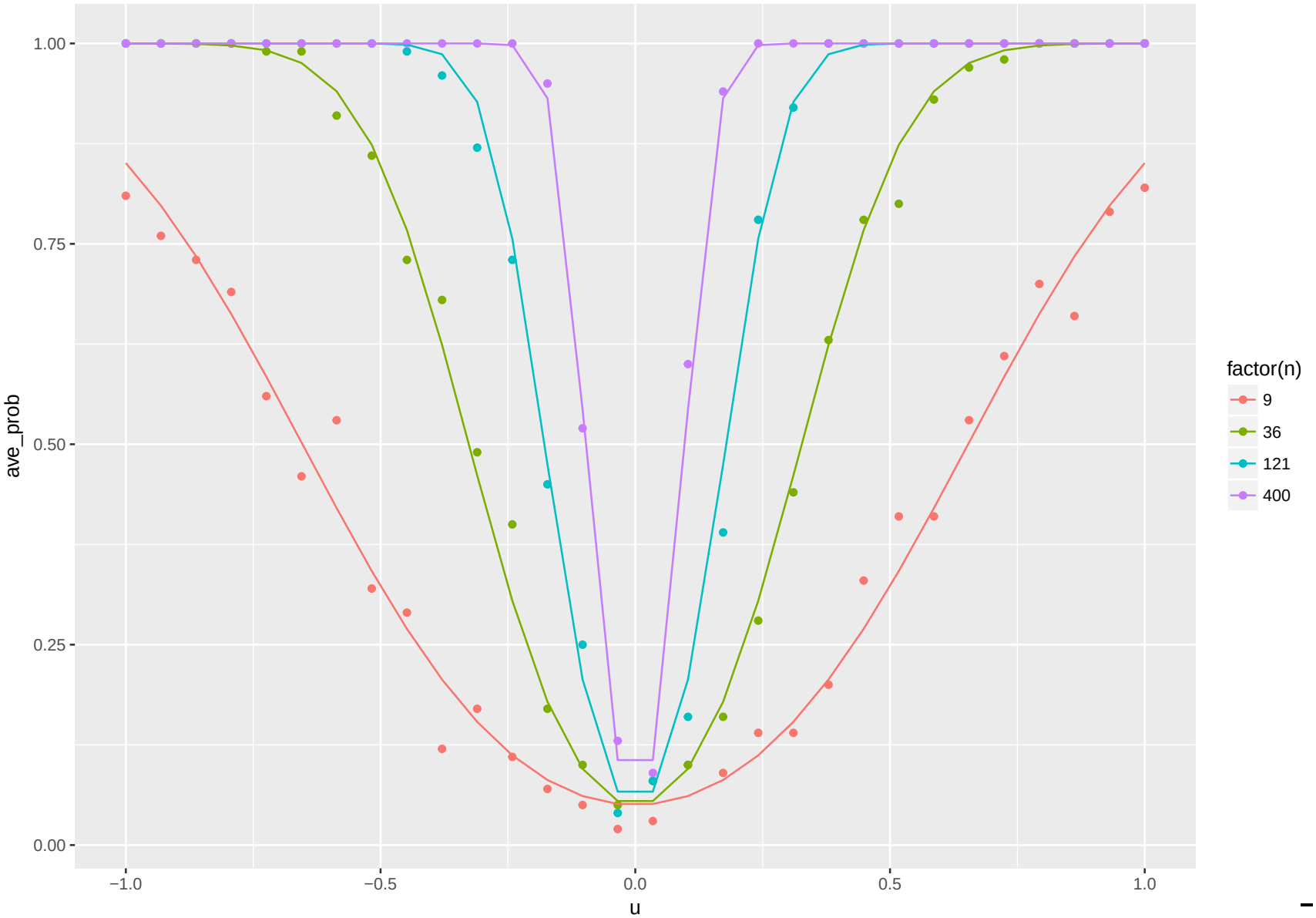
The power of a test is the probability of rejecting null hypothesis when the null is false. Hence, given μ and sample size, we could calculate this probability.

$$
\begin{aligned}
power =& Pr(reject\ H_0 | H_0\ not\ true) \\
=& Pr(\frac{\bar{x} - 0}{\sqrt{\frac{1}{n}}} > c | \mu = \mu^*) + Pr(\frac{\bar{x} - 0}{\sqrt{\frac{1}{n}}} < -c | \mu = \mu^*) \\
=& Pr(\frac{\bar{x} - \mu^*}{\sqrt{\frac{1}{n}}} > \frac{c\sqrt{\frac{1}{n}} - \mu^*}{\sqrt{\frac{1}{n}}} | \mu = \mu^*) + \\
& Pr(\frac{\bar{x} - \mu^*}{\sqrt{\frac{1}{n}}} < \frac{-c\sqrt{\frac{1}{n}} - \mu^*}{\sqrt{\frac{1}{n}}} | \mu = \mu^*) \\
=& 1 - \Phi(c - \frac{\mu^*}{\sqrt{\frac{1}{n}}}) + \Phi(-c - \frac{\mu^*}{\sqrt{\frac{1}{n}}})
\end{aligned}
$$

Question 1

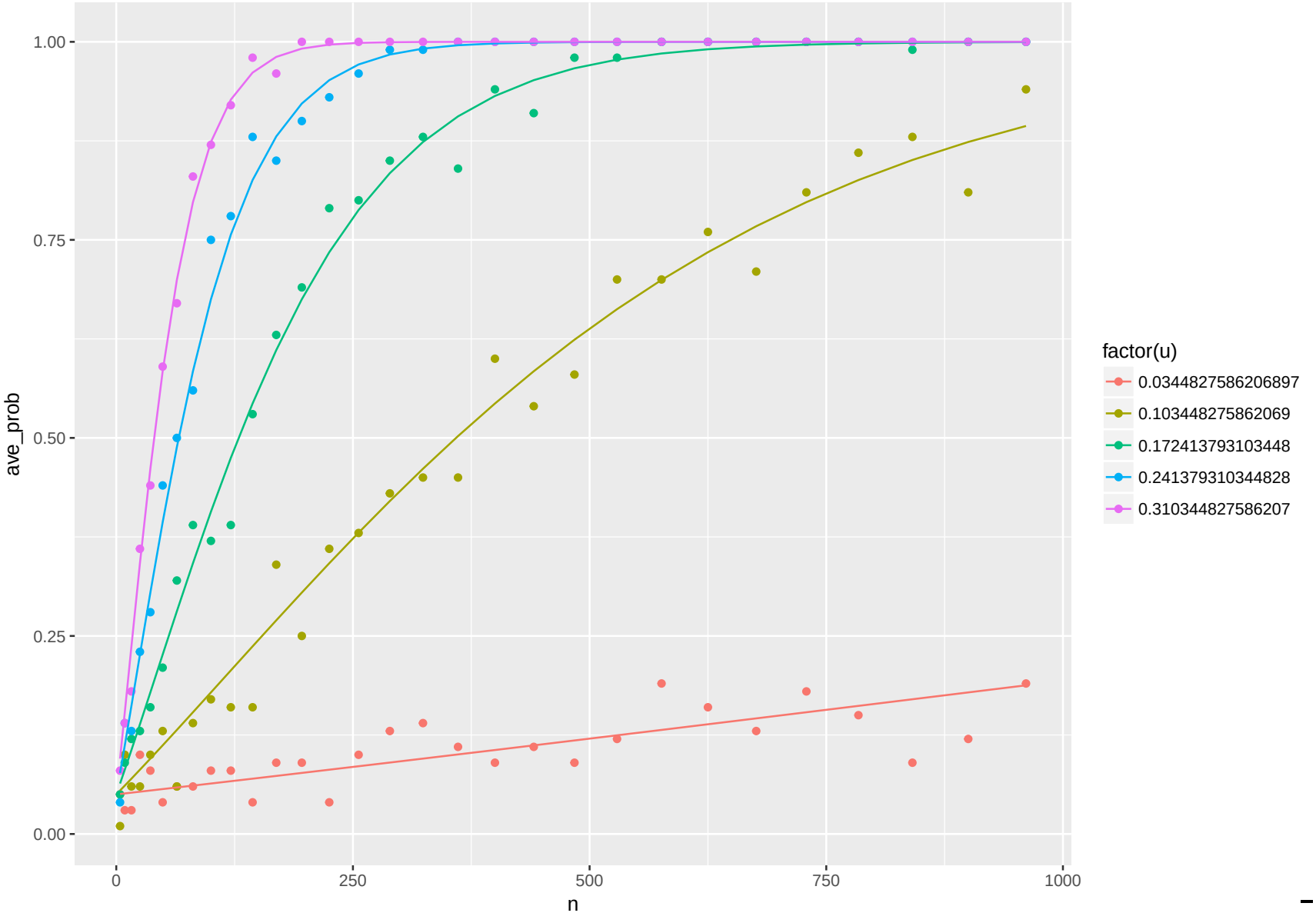

1.0
0.5
0.0
−0.5
−1.0
u
4 9 16 25 36 49 64 81 100 121 144 169 196 225 256 289 324 361 400 441 484 529 576 625 676 729 784 841 900 961
factor(n)
ave_prob
1.00
0.75
0.50
0.25

Question 2



Note: Dots are simulated data. Lines are analytical curves.

Question3



Note: Dots are simulated data. Lines are analytical curves.

Question5

- When n=500, I expect to detect a difference of 1 in my outcome variable with almost 100% confidence.
- When the sample size is 11, we could detect a difference of 1 with 90% confidence.

```
## [1] 1
```

```
## [1] 11
```