PASW (SPSS)/Excel Workshop 2 – Semester Two, 2010

In Assignment 2 of STATS 10x you will need to use Excel or PASW (SPSS) to perform some calculations, that is, finding Normal probabilities and Inverse Normal values in **Question 3**.

You may also like to use Excel to check you've done your 'by hand' calculations correctly for your confidence interval in **Question 6**.

Instructions from your assignment sheet read:

Question guide
• Question 3 will require use of Excel, PASW or a graphics calculator for calculating probabilities from Normal distributions. Do not hand in any computer output for these questions. Use Excel, PASW or a graphics calculator to find the solutions. **DO NOT USE TABLES.**
Question 3. [9 marks] [Chapter 6] **Reminder:** When calculating Normal probabilities, use PASW (SPSS), Excel or a graphics calculator. **Do not use tables.** Report any probabilities to **4 decimal places**.

On the following pages are some questions from the **Worked Examples** which you can find on Cecil.

Question 6 [Chapter 6] (helpful for Question 3, Assignment 2)

A medical trial was conducted to investigate whether a new drug extended the life of a patient who had lung cancer. The survival times (in months) for 38 cancer patients who were treated with the drug are as follows:

1, 1, 5, 9, 10, 13, 14, 17, 18, 18, 19, 21, 22, 25, 25, 25, 26, 27, 29,
36, 38, 39, 39, 40, 41, 41, 43, 44, 44, 45, 46, 46, 49, 50, 50, 54, 54, 59.

Sample mean ≈ 31.1 months and sample standard deviation ≈ 16.0 months.

Assume that the survival time (in months) for patients on this drug is Normally distributed with a mean of 31.1 months and a standard deviation of 16.0 months.

(i) What is the probability that a patient survives for no more than one year?

(ii) What percentage of patients survive for at least two years?

(iii) What proportion of patients will survive between one year and two years?

(iv) What is the highest survival time that 80% of patient survival times exceed?

(v) What is the lower quartile of the survival times?

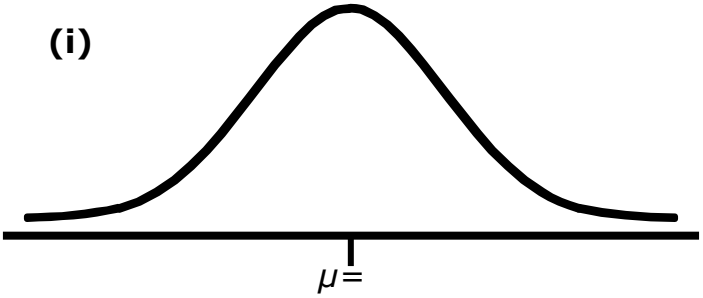
(vi) Calculate the central 80% of survival times.

Question 6 Solutions

Let X be the survival time ( ) for a patient on the drug.

$X \sim$ Normal ($\mu =$ _____, $\sigma =$ _____)

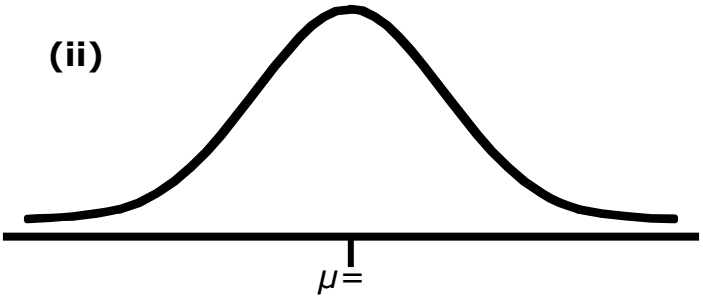
(i)



Pr(X)

= (4dp)

(ii)



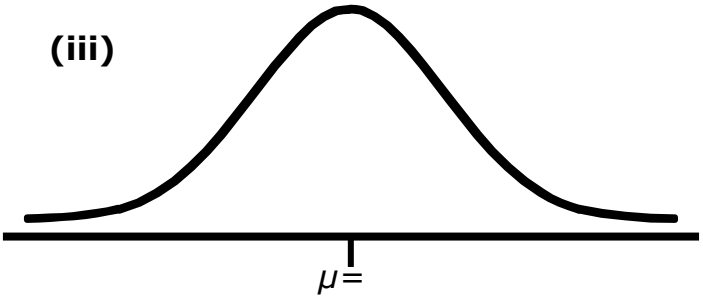
Pr(X)

=

=

= (2dp)

(iii)



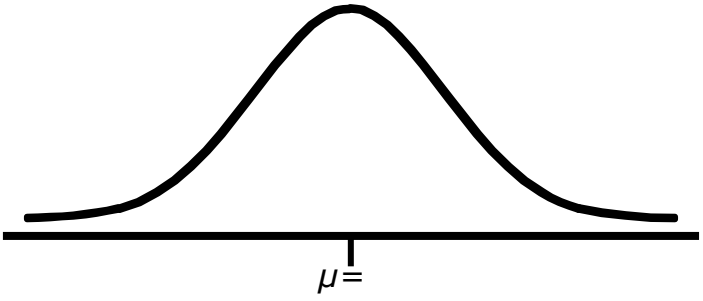
Pr( )

= Pr( ) – Pr( )

=

= (4dp)

(iv) We want to calculate x such that Pr($X \geq x$) =

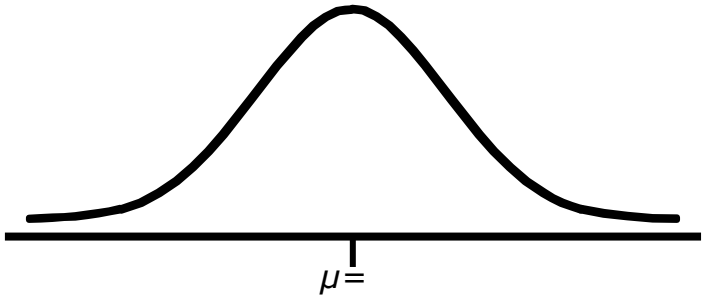


$\Rightarrow$ Pr($X \leq x$) =

$\Rightarrow x =$ (1dp)

The highest survival time that 80% of patient survival times exceed is _____ months.

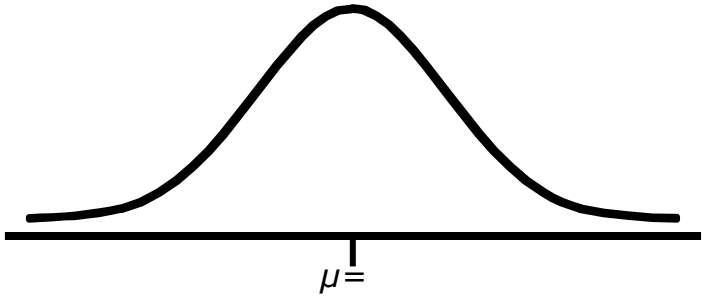
(v) We want to calculate x such that $\Pr(X \leq x) =$



$\Rightarrow x =$ (1dp)

The lower quartile of the survival times is _____ months.

(vi) For the central 80% of survival times: $\Pr(x_L \leq X \leq x_U) = 0.80$



$\Rightarrow \Pr(X \leq x_L) =$

$\Rightarrow x_L =$ (1dp)

$\Pr(x_L \leq X \leq x_U) = 0.80$

$\Rightarrow \Pr(X \leq x_U) =$

$\Rightarrow x_U =$ (1dp)

The central 80% of survival times fall between _____ months and _____ months.

Calculating Normal Probabilities in *Excel*

A. Lower tail probabilities: $\Pr(X \leq x)$

Example: Find $\Pr(X \leq 5)$ where $X \sim \text{Normal}(\mu = 7, \sigma = 6)$

1. Click in cell A1.

2. Click the **Insert Function** button  from beside the formula bar.

3. Choose **Statistical** from the **Or select a category** box in the **Insert Function** dialog box.

4. Choose **NORMDIST** from the **Select a function** box (Figure 1).

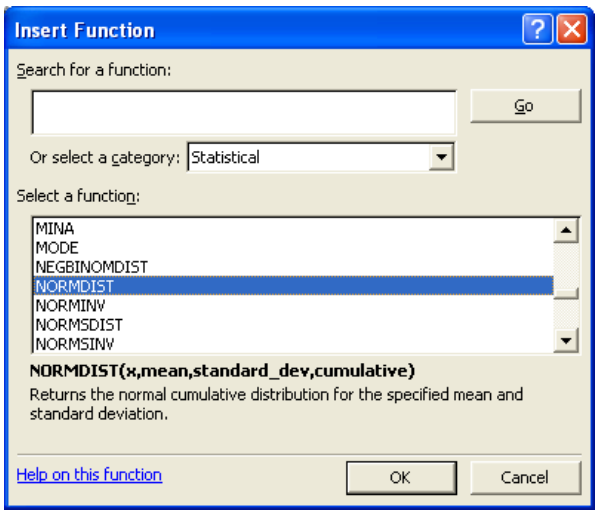


Figure 1

5. Click **OK**.

6. Fill in the **NORMDIST** dialog box (Figure 2).

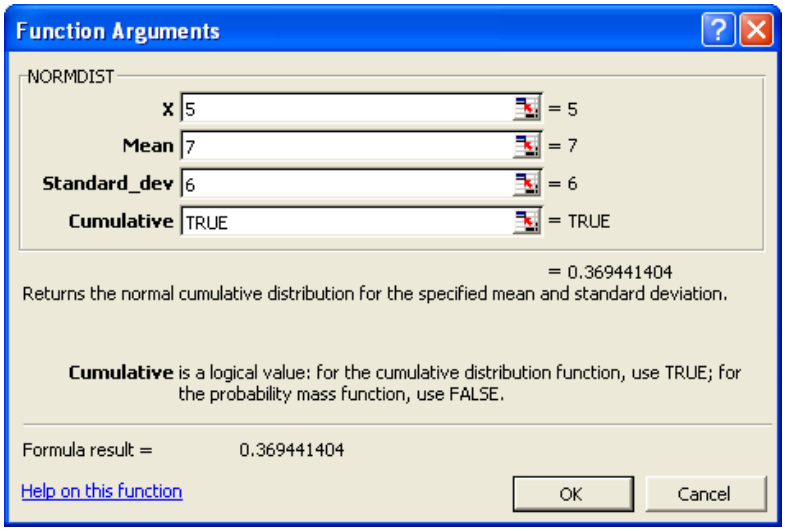


Figure 2

where:

X	is the value for which we want the distribution. It is equivalent to x in our manual. In this example, we put 5 in this box.
Mean	is the mean of the distribution. It is equivalent to μ in our manual. In this example, we put 7 in this box.
Standard_dev	is the standard deviation of the distribution. It is equivalent to σ in our manual. In this example, we put 6 in this box.
Cumulative	indicates whether we want a cumulative distribution function (TRUE or 1) or a probability mass function (FALSE or 0). We will always put TRUE or 1 in this box.

7. Click **OK**. (The value of 0.369 should appear in cell A1.)

B. Upper tail probabilities: Pr($X \geq x$)

Example: Find Pr($X \geq 9$) where $X \sim$ Normal($\mu = 7$, $\sigma = 6$)

Note: Pr($X \geq 9$) = 1 – Pr($X \leq 9$)

1. Evaluate Pr($X \leq 9$) in cell B1 (use steps in A).

2. In cell B2, type: **=1 – B1**.

3. Press **Enter**. (The value of 0.369 should appear in cell B2.)

C. Pr(a ≤ *X* ≤ b)

Example: Find Pr(5 ≤ *X* ≤ 11) where *X* ~ Normal(μ = 7, σ = 6)

Note: Pr(5 ≤ *X* ≤ 11) = Pr(*X* ≤ 11) – Pr(*X* ≤ 5)

1. Evaluate Pr(*X* ≤ 11) in cell C1 (use steps in A).

2. Evaluate Pr(*X* ≤ 5) in cell C2 (use steps in A).

3. In cell C3, type: **=C1 – C2**.

4. Press **Enter**. (The value of 0.378 should appear in cell C3.)

Note:

Another way to calculate Normal probabilities is to type the function **=NORMDIST(*x*, μ, σ, *c*)** directly into a cell, where:

x is the value for which we want the distribution.

μ is the mean of the distribution.

σ is the standard deviation of the distribution

c is always 1.

For example:

To evaluate Pr(*X* ≤ 5): In cell A1, type: **=NORMDIST(5, 7, 6, 1)**.

To evaluate Pr(*X* ≥ 9): In cell B1, type: **=NORMDIST(9, 7, 6, 1)**

In cell B2, type: **=1 – B1**.

To evaluate Pr(5 ≤ *X* ≤ 11): In cell C1, type: **=NORMDIST(11, 7, 6, 1)**.

In cell C2, type: **=NORMDIST(5, 7, 6, 1)**.

In cell C3, type: **=C1 – C2**.

	A	B	C
1	=NORMDIST(5, 7, 6, 1)	=NORMDIST(9, 7, 6, 1)	=NORMDIST(11, 7, 6, 1)
2		=1 - B1	=NORMDIST(5, 7, 6, 1)
3			=C1 - C2

Figure 3

Calculating the Inverse of the Normal Distribution

Sometimes the *x*-value for a specified probability is required.

Example: What mark would a student have to get more than, in order to be in the top 25% of the class, if the mean mark was 65 out of 100 and the standard deviation was 9?

1. Click in cell A1.

2. Click the **Insert Function** button  from beside the formula bar.

3. Choose **Statistical** from the **Function category** list box in the **Paste Function** dialog box.

4. Choose **NORMINV** from the **Function name** list box (Figure 4).

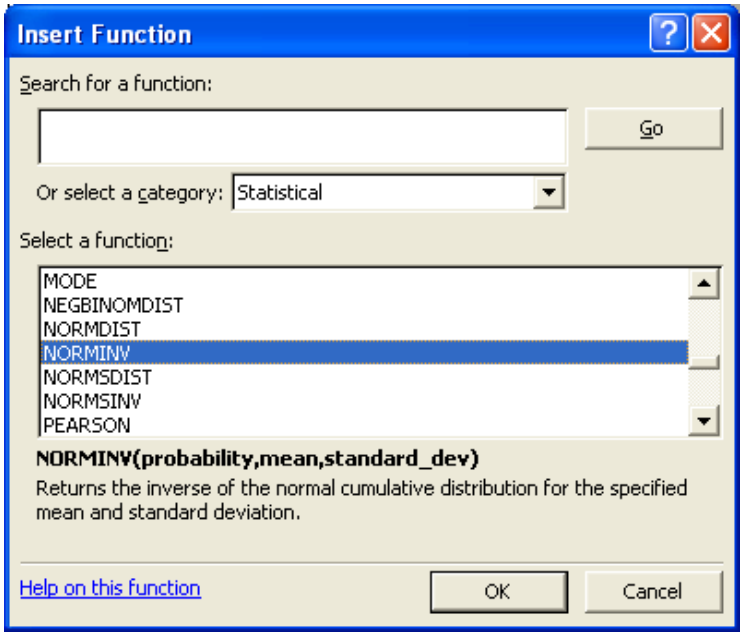


Figure 4

5. Click **OK**.

6. Fill in the **NORMINV** dialog box (Figure 5).

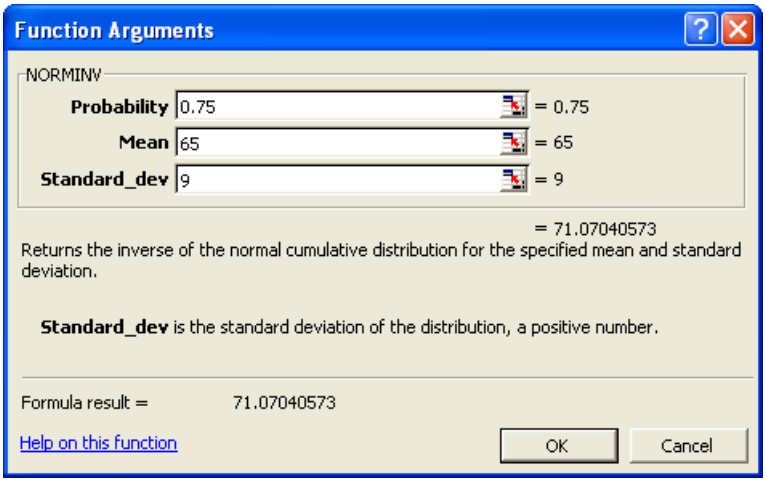


Figure 5

Note: the Excel function **NORMINV** determines the *x*-value for the probability that is to the left of the required *x*-value. In this example we want the *top* 25% therefore we use 1 – 0.25, or 0.75 for the probability. If instead we wanted the *bottom* 25% the probability is 0.25.

7. Click **OK**. (The value of 71.0704 should appear in cell A1.)

Note:

The formula can be directly entered into the cell by typing **=NORMINV(*p*, *μ*, *σ*)**, where:

p	is the probability to the left of the *x*-value being calculated
μ	is the mean of the distribution
σ	is the standard deviation of the distribution

Note:

Excel has two other functions that work in the same manner as the functions explained above. These two functions are **NORMSDIST** and **NORMSINV**. These two functions calculate the value for a standard normal distribution,

ie. $X \sim \text{Normal}(0, 1)$.

Calculating the *t*-multiplier

(Calculating the Inverse of the Student *t*-distribution)

Example: Find the *t*-multiplier for a 95% confidence interval with degrees of freedom, *df* = 29. (So we had a sample size, *n,* of 30, so *df*= *n* – 1 = 30 – 1 = 29).

1. Click in cell A1.

2. Click the **Insert Function** button  from beside the formula bar.

3. Choose **Statistical** from the **Or select a category** box in the **Insert Function** dialog box.

4. Choose **TINV** from the **Select a function** box (Figure 4).

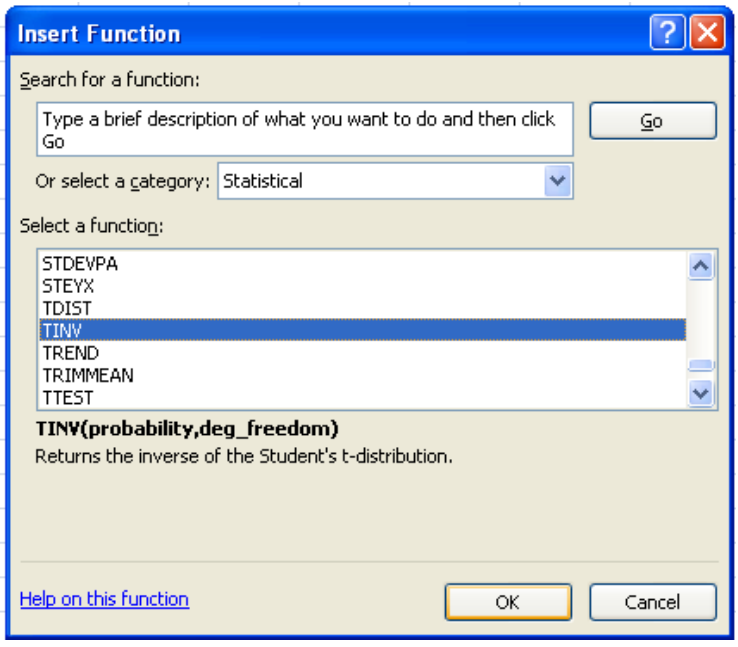


Figure 4

5. Click **OK**

6. Fill in the **TINV** dialog box (Figure 5).

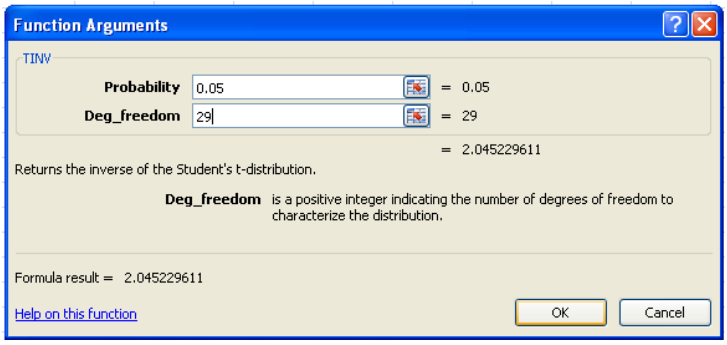


Figure 5

Note:

The *Excel* function **TINV** calculates the *t*-value for two–tailed *t*-distribution. So if we want to find the *t*-value whose probability to the right is 0.1, then in the **TINV** function the value for the probability is entered as 0.2, because of the two-tailed nature of the function.

7. Click **OK**. (The value 2.045 should appear in cell A1.)

Note:

The example can be solved by directly typing the formula **=TINV(*p*, *df*)** into the cell, where:

p is the probability for the two-tailed distribution

df is the number of degrees of freedom for the distribution

Useful places to look for help by assignment question

Assignment question number	***Worked Examples*** question number	***Lecture Workbook*** page number
Q1		
Q2		
Q3		
Q4		
Q5		
Q6		

Also, don't forget where you can get assignment help!

- **Statistics Assistance Area** – ask a tutor or your neighbour
- **Statistics Computer Lab** – ask a lab demonstrator or your neighbour
- The STATS 10x **forum**: www.stat.auckland.ac.nz/forum/10x
- Your **lecturer's office hours**! See Cecil for details – if they don't suit you, email or call them to book a time.

Downloading the Excel Test and Confidence Interval Calculators

These are available to you in two places:

1. From Cecil (log in to Cecil in the usual way, click on **Assignment Resources** and look for **"Single proportion/One proportion"** and **"Two proportions"**
2. Go to Leila's Student Learning Centre STATS 10x webpage www.stat.auckland.ac.nz/~leila

Whichever way you do it, access **Two proportions.xls** now.

Let's have a go at using the **Two proportions.xls** *document!*

We won't be doing the calculations by hand, although you are welcome to try later – in this workshop we'll use Excel to do them!

Question 10 [Chapter 8] (similar to Question 6, Assignment 2)

In April 1996 the New Zealand Consumers' Institute conducted a survey on home computer use. 7400 subscribers to Consumer Magazine were randomly selected and sent a survey form. Of those surveyed, 2730 had a computer for personal use at home. The respondents who had a home computer were given a list of computer activities and were asked to indicate all of those that they engaged in. They were also asked to indicate the number of hours per week that they used their computer. The Consumers' Institute used the results to draw conclusions about subscribers **who own a home computer**. The results of the survey are given in the two tables below.

Computer Activities	
Word-processing	2621
Games	1502
Spreadsheets	819
Accounting	655
Databases	437
Internet	328
Drawing	300
Desktop publishing	246
Fax / answering machine	82

Computer Use (hours per week)	
Not used	27
Used for less than 2 hours	328
Over 2 and up to 7 hours (incl)	764
Over 7 and up to 14 hours (incl)	710
Over 14 and up to 21 hours (incl)	546
Over 21 and up to 28 hours (incl)	109
Over 28 and up to 35 hours (incl)	136
Over 35 and up to 44 hours (incl)	55
Over 44 hours	55
Total	2730

(c) Identify the sampling situation as (a) *Two independent samples*, (b) *Single sample, several response categories* or (c) *Single sample, two or more Yes/No items* in the following cases:

(i) Consider the results from the New Zealand Consumers' Institute survey on home computer use above. We want to compare the proportion of respondents who use their home computer for spreadsheets with the proportion of respondents who use their home computer for accounting.

(ii) Consider the results from the New Zealand Consumers' Institute survey on home computer use above. We want to compare the proportion of respondents who use their home computer for over 7 and up to 14 hours per week and the proportion of respondents who use their home computer for over 14 and up to 21 hours per week.

(iii) As part of a nationwide telephone survey in 1998, data was collected on people who use their home computers for Internet activities. We want to compare the proportion of respondents (in this survey) who use their home computer for the Internet to the proportion of respondents from the Consumers' Institute survey who use their home computer for the Internet.

(d) By hand, calculate a 95% confidence interval for the difference between the proportion of people who use their computer for drawing and the proportion of people who use their computer for desktop publishing. Interpret your results.

1 Parameter = $p_D - p_P$, the difference in the true proportion of people with a home computer who use it for drawing and the true proportion who use it for desktop publishing.

2 Estimate $= \hat{p}_D - \hat{p}_P$, the difference in the proportion of respondents with a home computer who use it for drawing and the proportion who use it for desktop publishing.

$$= \hat{p}_D - \hat{p}_P = \frac{300}{2730} - \frac{246}{2730} = 0.1099 - 0.0901 = 0.0198$$

3 Formula = *estimate* $\pm\, t \times$ se*(estimate)* gives
$(\hat{p}_D - \hat{p}_P) \pm t \times \text{se}(\hat{p}_D - \hat{p}_P)$

4 Situation (c): One sample, two or more Yes/No items.

$\hat{p}_D + \hat{p}_P = 0.1099 + 0.0901 = 0.2$, $\hat{q}_D + \hat{q}_P = 0.8901 + 0.9099 = 1.8$

$$\text{se}(\hat{p}_D - \hat{p}_P) = \sqrt{\frac{0.2 - 0.0198^2}{2730}} = 0.008550816 \approx 0.008551$$

5 $df = \infty$ (working with proportions)

6 For a 95% confidence interval with $df = \infty$, use $t = z = 1.96$

7 95% confidence interval is: $(\hat{p}_D - \hat{p}_P) \pm z \times \text{se}(\hat{p}_D - \hat{p}_P)$

= 0.0198 ± 1.96 × 0.008551

= 0.0198 ± 0.016760

= (0.0030, 0.0366)

8 With 95% confidence, we estimate that the true proportion of people with a home computer who use it for drawing to be up to 0.04 higher than the true proportion who use it for desktop publishing.