**CMD 305 - COURSE**

**(RESEARCH METHODOLOGY & BIOSTATISTICS)**

**(1433 – 1434)**

**TUTORIAL TOPIC: Sample size estimation (solutions)**

**-------------------------------------------------------------------------------------------------------------------------------------------------------**

**Q1) We want to estimate the mean systolic blood pressure of Saudi females. The standard deviation is around 20 mmHg and we wish to estimate the true mean to within 10 mmHg with 95% confidence. What is the required sample size ?**

**Solution:** You can get sample size in two ways:

(1) Sample size n = Z2αs2 /d2

Given : s=20 and d=10 Zα= 1.96 for 95% confidence level

Then n = (1.96)2x(20)2/(10)2 = 15.37

Since we cannot take 0.37 of a person, we round up to 16 women as our sample size.

(2) By using tables (Table.1A)

--------------------------------------------------------------------------------------------

**Q2) A public health department wanted an estimate of average retail price of twenty tablets of a commonly used tranquilizer sold in retail pharmacies of its region. How many sample of pharmacies is to be selected such that the estimate is required to be with in5 riyals of the true average price with95% confidence. (Based on a small pilot study , it was found the sd of price is 10 riyals).**

**Solution:**

we can get the sample size by two ways 1) by formula and 2) By using ready made Table 1A

(1) Sample size n = Z2αS2 /d2

Given :s=10 and d=5 Zα= 1.96 for 95% level of confidence

Then n = (1.96)2x(10)2 /(5)2 = 16 pharmacies are to selected among the pharmacies of that region.

**Q3) We wish to estimate the proportion of Saudi males who smoke. What sample size do we require to achieve a 95% confidence interval of width ± 5% ( that is to be within 5% of the true value) ? A study some years ago found approximately 30% were smokers ?**

**Solution**: You can get sample size in two ways:

(1) Sample size n = Z2αp(1-p)/d2

Given : p=0.3 d=.05 Zα= 1.96 for 95% confidence level

Then n = (1.96)2(0.3)(0.7)/(0.05)2 = 322.7 rounded to 323

We need 323 Saudi males as our sample size to estimate the proportion of Saudi males who smoke.

(2) By using tables (Table.1B)

--------------------------------------------------------------------------------------------

**Q4) An epidemiologist was asked to asked to estimate the proportionof children in a region receiving appropriate childhood vaccinations. How many children he should select, if the resulting estimate is to fall within 10 percentage points of the true proportion with 95% confidence?.(From a pilot study he came to know that this rate is 20%)**

**Solution:** You can get sample size in two ways:1) by formula and 2) by using readymade Table 1B

(1) Sample size n = Z2αP(1-P)/d2

Given : P=0.2 d=0.10 Zα= 1.96 for 95% confidence level

Then n = (1.96)2(0.2)(0.8)/(0.1)2 = 62

He needs 62 children as his sample to estimate the proportion of children in a region receiving appropriate childhood vaccinations.

**Q5) An epidemiologist wants to test whether a iron supplement for pregnant women will increase the increase their Hb level. One group of women will receive new supplement and the other group the usual supplement. From a pilot study the sd of Hb is 4 g/dl and is assumed to be same for both groups.. what is the sample size required to test the hypothesis of no difference in mean Hb level at 99% level of confidence and 90% power of detecting an increase of 2 g/dl.**

**Solution:** You can get sample size in two ways: 1) by using formula and (2) By using readymade tables (Table.2A)

(1) Sample size n =2S2 (Zα+Zβ)2 /d2 per arm

Given d=2, S=4,

Zα = 2.58 for 99% level of confidenceand

Zβ = 1.28 for 90% power

Then n = 2 x42 (2.58+1.28)2 /(2)2 = 119

We require at least 119 per group ( Total 238 women)

(2) By using tables (Table.2A)

**Q6.Suppose it has been estimated that the rate of caries is 800 per 1000 school children in one district and 600 per 1000 in another district. What is the sample size required from each district to determine whether the difference is significant at the 95% level if we wish to have an 90% of chance of detecting the difference if it is real?**

**Solution**: You can get sample size in two ways:1) by using formula and (2) By using readymade table (Table.2B)

(1) Sample size .

Given p1=80% and p2=60% ;

Zα= 1.96 for 95% confidence level ;

Zβ= 1.282 for 90% power

n= (1.96+1.282)2((0.8x0.2)+(0.6x0.4)) **/** (0.8-0.6)2

= 105 patients for each group Total sample size=210 children

.

**Sample size formulae**

|  |
| --- |
| A) If outcome variable is quantitative/continuous then outcome measure is **mean**  Example: Height, weight, BMI, HB, BP etc., |
| For **a single mean** Sample size : n = Z2α S2 /d2  Where , **S** (=sd, get from the literature review or from the pilot study ) |
| **Fortwo means**Sample size **:**n =2S2 (Zα+Zβ)2 /d2 , per arm    Where , **S** (=sd, get from the literature review or from the pilot study ) |

|  |
| --- |
| B) If outcome variable is qualitative/categorical then outcome measure is **proportion**  Example: proportion of smokers, diabetes, anemia etc., |
| **For a single proportion**Sample size **:**n = Z2α P(1-P)/d2  Where , **P** (=proportion, get from the literature review or from the pilot study ) |
| **For two proportions**Sample size **:**    Where , P1 and P2( are proportions for group1 and group2 we are studying ,for example , obese- non obese, smokers-non smokers etc., , get from the literature review or from the pilot study ) |
|  |
| **d = precision ( the researcher has to decide)**  **Zα = 1.96 for 95% confidence level, usually**  **Zβ = 1.282 for 90% power, usually** |
|  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1A** | **SAMPLE SIZES FOR A SINGLE MEAN FOR VARIOUS d and sd for 95% level, Za=1.96** | | | | | | | | | | | | | | | | | | | |
|  | **d** | | | | | | | | | | | | | | | | | | | |
| **sd** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **1** | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **2** | 16 | 4 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **3** | 35 | 9 | 4 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **4** | 62 | 16 | 7 | 4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **5** | 97 | 25 | 11 | 7 | 4 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **6** | 139 | 35 | 16 | 9 | 6 | 4 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **7** | 189 | 48 | 21 | 12 | 8 | 6 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **8** | 246 | 62 | 28 | 16 | 10 | 7 | 6 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **9** | 312 | 78 | 35 | 20 | 13 | 9 | 7 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **10** | 385 | 97 | 43 | 25 | 16 | 11 | 8 | 7 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| **11** | 465 | 117 | 52 | 30 | 19 | 13 | 10 | 8 | 6 | 5 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| **12** | 554 | 139 | 62 | 35 | 23 | 16 | 12 | 9 | 7 | 6 | 5 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **13** | 650 | 163 | 73 | 41 | 26 | 19 | 14 | 11 | 9 | 7 | 6 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 2 | 2 |
| **14** | 753 | 189 | 84 | 48 | 31 | 21 | 16 | 12 | 10 | 8 | 7 | 6 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 2 |
| **15** | 865 | 217 | 97 | 55 | 35 | 25 | 18 | 14 | 11 | 9 | 8 | 7 | 6 | 5 | 4 | 4 | 3 | 3 | 3 | 3 |
| **16** | 984 | 246 | 110 | 62 | 40 | 28 | 21 | 16 | 13 | 10 | 9 | 7 | 6 | 6 | 5 | 4 | 4 | 4 | 3 | 3 |
| **17** | 1111 | 278 | 124 | 70 | 45 | 31 | 23 | 18 | 14 | 12 | 10 | 8 | 7 | 6 | 5 | 5 | 4 | 4 | 4 | 3 |
| **18** | 1245 | 312 | 139 | 78 | 50 | 35 | 26 | 20 | 16 | 13 | 11 | 9 | 8 | 7 | 6 | 5 | 5 | 4 | 4 | 4 |
| **19** | 1387 | 347 | 155 | 87 | 56 | 39 | 29 | 22 | 18 | 14 | 12 | 10 | 9 | 8 | 7 | 6 | 5 | 5 | 4 | 4 |
| **20** | 1537 | 385 | 171 | 97 | 62 | 43 | 32 | 25 | 19 | 16 | 13 | 11 | 10 | 8 | 7 | 7 | 6 | 5 | 5 | 4 |
| **21** | 1695 | 424 | 189 | 106 | 68 | 48 | 35 | 27 | 21 | 17 | 15 | 12 | 11 | 9 | 8 | 7 | 6 | 6 | 5 | 5 |
| **22** | 1860 | 465 | 207 | 117 | 75 | 52 | 38 | 30 | 23 | 19 | 16 | 13 | 12 | 10 | 9 | 8 | 7 | 6 | 6 | 5 |
| **23** | 2033 | 509 | 226 | 128 | 82 | 57 | 42 | 32 | 26 | 21 | 17 | 15 | 13 | 11 | 10 | 8 | 8 | 7 | 6 | 6 |
| **24** | 2213 | 554 | 246 | 139 | 89 | 62 | 46 | 35 | 28 | 23 | 19 | 16 | 14 | 12 | 10 | 9 | 8 | 7 | 7 | 6 |
| **25** | 2401 | 601 | 267 | 151 | 97 | 67 | 49 | 38 | 30 | 25 | 20 | 17 | 15 | 13 | 11 | 10 | 9 | 8 | 7 | 7 |
| **26** | 2597 | 650 | 289 | 163 | 104 | 73 | 53 | 41 | 33 | 26 | 22 | 19 | 16 | 14 | 12 | 11 | 9 | 9 | 8 | 7 |
| **27** | 2801 | 701 | 312 | 176 | 113 | 78 | 58 | 44 | 35 | 29 | 24 | 20 | 17 | 15 | 13 | 11 | 10 | 9 | 8 | 8 |
| **28** | 3012 | 753 | 335 | 189 | 121 | 84 | 62 | 48 | 38 | 31 | 25 | 21 | 18 | 16 | 14 | 12 | 11 | 10 | 9 | 8 |
| **29** | 3231 | 808 | 359 | 202 | 130 | 90 | 66 | 51 | 40 | 33 | 27 | 23 | 20 | 17 | 15 | 13 | 12 | 10 | 9 | 9 |
| **30** | 3458 | 865 | 385 | 217 | 139 | 97 | 71 | 55 | 43 | 35 | 29 | 25 | 21 | 18 | 16 | 14 | 12 | 11 | 10 | 9 |
| **31** | 3692 | 923 | 411 | 231 | 148 | 103 | 76 | 58 | 46 | 37 | 31 | 26 | 22 | 19 | 17 | 15 | 13 | 12 | 11 | 10 |
| **32** | 3934 | 984 | 438 | 246 | 158 | 110 | 81 | 62 | 49 | 40 | 33 | 28 | 24 | 21 | 18 | 16 | 14 | 13 | 11 | 10 |
| **33** | 4184 | 1046 | 465 | 262 | 168 | 117 | 86 | 66 | 52 | 42 | 35 | 30 | 25 | 22 | 19 | 17 | 15 | 13 | 12 | 11 |
| **34** | 4441 | 1111 | 494 | 278 | 178 | 124 | 91 | 70 | 55 | 45 | 37 | 31 | 27 | 23 | 20 | 18 | 16 | 14 | 13 | 12 |
| **35** | 4706 | 1177 | 523 | 295 | 189 | 131 | 97 | 74 | 59 | 48 | 39 | 33 | 28 | 25 | 21 | 19 | 17 | 15 | 14 | 12 |
| **36** | 4979 | 1245 | 554 | 312 | 200 | 139 | 102 | 78 | 62 | 50 | 42 | 35 | 30 | 26 | 23 | 20 | 18 | 16 | 14 | 13 |
| **37** | 5260 | 1315 | 585 | 329 | 211 | 147 | 108 | 83 | 65 | 53 | 44 | 37 | 32 | 27 | 24 | 21 | 19 | 17 | 15 | 14 |
| **38** | 5548 | 1387 | 617 | 347 | 222 | 155 | 114 | 87 | 69 | 56 | 46 | 39 | 33 | 29 | 25 | 22 | 20 | 18 | 16 | 14 |
| **39** | 5844 | 1461 | 650 | 366 | 234 | 163 | 120 | 92 | 73 | 59 | 49 | 41 | 35 | 30 | 26 | 23 | 21 | 19 | 17 | 15 |
| **40** | 6147 | 1537 | 683 | 385 | 246 | 171 | 126 | 97 | 76 | 62 | 51 | 43 | 37 | 32 | 28 | 25 | 22 | 19 | 18 | 16 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1B** | **SAMPLE SIZESFOR A SINGLE PROPORTION FOR VARIOUS P and d for 95% level, Za=1.96** | | | | | | | | | | | | | | | | | | | |
|  | **d** | | | | | | | | | | | | | | | | | | | |
| **P** | **0.05** | **0.10** | **0.15** | **0.20** | **0.25** | **0.30** | **0.35** | **0.40** | **0.45** | **0.50** | **0.55** | **0.60** | **0.65** | **0.70** | **0.75** | **0.80** | **0.85** | **0.90** | **0.95** | **1.00** |
| **0.01** | 16 | 4 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.02** | 31 | 8 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.03** | 45 | 12 | 5 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.04** | 60 | 15 | 7 | 4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.05** | 73 | 19 | 9 | 5 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.06** | 87 | 22 | 10 | 6 | 4 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.07** | 101 | 26 | 12 | 7 | 5 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.08** | 114 | 29 | 13 | 8 | 5 | 4 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.09** | 126 | 32 | 14 | 8 | 6 | 4 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.1** | 139 | 35 | 16 | 9 | 6 | 4 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.11** | 151 | 38 | 17 | 10 | 7 | 5 | 4 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.12** | 163 | 41 | 19 | 11 | 7 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.13** | 174 | 44 | 20 | 11 | 7 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.14** | 186 | 47 | 21 | 12 | 8 | 6 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.15** | 196 | 49 | 22 | 13 | 8 | 6 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.16** | 207 | 52 | 23 | 13 | 9 | 6 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.17** | 217 | 55 | 25 | 14 | 9 | 7 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| **0.18** | 227 | 57 | 26 | 15 | 10 | 7 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **0.19** | 237 | 60 | 27 | 15 | 10 | 7 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **0.2** | 246 | 62 | 28 | 16 | 10 | 7 | 6 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **0.21** | 255 | 64 | 29 | 16 | 11 | 8 | 6 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| **0.22** | 264 | 66 | 30 | 17 | 11 | 8 | 6 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **0.23** | 273 | 69 | 31 | 18 | 11 | 8 | 6 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **0.24** | 281 | 71 | 32 | 18 | 12 | 8 | 6 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **0.25** | 289 | 73 | 33 | 19 | 12 | 9 | 6 | 5 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **0.26** | 296 | 74 | 33 | 19 | 12 | 9 | 7 | 5 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **0.27** | 303 | 76 | 34 | 19 | 13 | 9 | 7 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **0.28** | 310 | 78 | 35 | 20 | 13 | 9 | 7 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **0.29** | 317 | 80 | 36 | 20 | 13 | 9 | 7 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **0.3** | 323 | 81 | 36 | 21 | 13 | 9 | 7 | 6 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **0.31** | 329 | 83 | 37 | 21 | 14 | 10 | 7 | 6 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **0.32** | 335 | 84 | 38 | 21 | 14 | 10 | 7 | 6 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **0.33** | 340 | 85 | 38 | 22 | 14 | 10 | 7 | 6 | 5 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **0.34** | 345 | 87 | 39 | 22 | 14 | 10 | 8 | 6 | 5 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **0.35** | 350 | 88 | 39 | 22 | 14 | 10 | 8 | 6 | 5 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **0.36** | 355 | 89 | 40 | 23 | 15 | 10 | 8 | 6 | 5 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **0.37** | 359 | 90 | 40 | 23 | 15 | 10 | 8 | 6 | 5 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| **0.38** | 363 | 91 | 41 | 23 | 15 | 11 | 8 | 6 | 5 | 4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| **0.39** | 366 | 92 | 41 | 23 | 15 | 11 | 8 | 6 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| **0.4** | 369 | 93 | 41 | 24 | 15 | 11 | 8 | 6 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Table 2A SAMPLE SZES FOR TWO MEANS FOR VARIOUS VALUES OF D AND SD**  **Za for 99% level=2.58**  **Zb for 90% power = 1.28 d** | | | | | | | | | | | | | | | | | | | |
| **Sd** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| **1** | 30 | 7 | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2** | 119 | 30 | 13 | 7 | 5 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| **3** | 268 | 67 | 30 | 17 | 11 | 7 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **4** | 477 | 119 | 53 | 30 | 19 | 13 | 10 | 7 | 6 | 5 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| **5** | 745 | 186 | 83 | 47 | 30 | 21 | 15 | 12 | 9 | 7 | 6 | 5 | 4 | 4 | 3 | 3 | 3 | 2 | 2 | 2 |
| **6** | 1073 | 268 | 119 | 67 | 43 | 30 | 22 | 17 | 13 | 11 | 9 | 7 | 6 | 5 | 5 | 4 | 4 | 3 | 3 | 3 |
| **7** | 1460 | 365 | 162 | 91 | 58 | 41 | 30 | 23 | 18 | 15 | 12 | 10 | 9 | 7 | 6 | 6 | 5 | 5 | 4 | 4 |
| **8** | 1907 | 477 | 212 | 119 | 76 | 53 | 39 | 30 | 24 | 19 | 16 | 13 | 11 | 10 | 8 | 7 | 7 | 6 | 5 | 5 |
| **9** | 2414 | 603 | 268 | 151 | 97 | 67 | 49 | 38 | 30 | 24 | 20 | 17 | 14 | 12 | 11 | 9 | 8 | 7 | 7 | 6 |
| **10** | 2980 | 745 | 331 | 186 | 119 | 83 | 61 | 47 | 37 | 30 | 25 | 21 | 18 | 15 | 13 | 12 | 10 | 9 | 8 | 7 |
| **11** | 3606 | 901 | 401 | 225 | 144 | 100 | 74 | 56 | 45 | 36 | 30 | 25 | 21 | 18 | 16 | 14 | 12 | 11 | 10 | 9 |
| **12** | 4291 | 1073 | 477 | 268 | 172 | 119 | 88 | 67 | 53 | 43 | 35 | 30 | 25 | 22 | 19 | 17 | 15 | 13 | 12 | 11 |
| **13** | 5036 | 1259 | 560 | 315 | 201 | 140 | 103 | 79 | 62 | 50 | 42 | 35 | 30 | 26 | 22 | 20 | 17 | 16 | 14 | 13 |
| **14** | 5841 | 1460 | 649 | 365 | 234 | 162 | 119 | 91 | 72 | 58 | 48 | 41 | 35 | 30 | 26 | 23 | 20 | 18 | 16 | 15 |
| **15** | 6705 | 1676 | 745 | 419 | 268 | 186 | 137 | 105 | 83 | 67 | 55 | 47 | 40 | 34 | 30 | 26 | 23 | 21 | 19 | 17 |
| **16** | 7629 | 1907 | 848 | 477 | 305 | 212 | 156 | 119 | 94 | 76 | 63 | 53 | 45 | 39 | 34 | 30 | 26 | 24 | 21 | 19 |
| **17** | 8612 | 2153 | 957 | 538 | 344 | 239 | 176 | 135 | 106 | 86 | 71 | 60 | 51 | 44 | 38 | 34 | 30 | 27 | 24 | 22 |
| **18** | 9655 | 2414 | 1073 | 603 | 386 | 268 | 197 | 151 | 119 | 97 | 80 | 67 | 57 | 49 | 43 | 38 | 33 | 30 | 27 | 24 |
| **19** | 10758 | 2689 | 1195 | 672 | 430 | 299 | 220 | 168 | 133 | 108 | 89 | 75 | 64 | 55 | 48 | 42 | 37 | 33 | 30 | 27 |
| **20** | 11920 | 2980 | 1324 | 745 | 477 | 331 | 243 | 186 | 147 | 119 | 99 | 83 | 71 | 61 | 53 | 47 | 41 | 37 | 33 | 30 |
| **21** | 13141 | 3285 | 1460 | 821 | 526 | 365 | 268 | 205 | 162 | 131 | 109 | 91 | 78 | 67 | 58 | 51 | 45 | 41 | 36 | 33 |
| **22** | 14423 | 3606 | 1603 | 901 | 577 | 401 | 294 | 225 | 178 | 144 | 119 | 100 | 85 | 74 | 64 | 56 | 50 | 45 | 40 | 36 |
| **23** | 15764 | 3941 | 1752 | 985 | 631 | 438 | 322 | 246 | 195 | 158 | 130 | 109 | 93 | 80 | 70 | 62 | 55 | 49 | 44 | 39 |
| **24** | 17164 | 4291 | 1907 | 1073 | 687 | 477 | 350 | 268 | 212 | 172 | 142 | 119 | 102 | 88 | 76 | 67 | 59 | 53 | 48 | 43 |
| **25** | 18625 | 4656 | 2069 | 1164 | 745 | 517 | 380 | 291 | 230 | 186 | 154 | 129 | 110 | 95 | 83 | 73 | 64 | 57 | 52 | 47 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 2B Sample sizes for two proportions at 95% Confidence level, (Zα=1.96) and for 90% Power( Zβ= 1.282)** | | | | | | | | | | | | | | | | | | | |
|  | ***P1****(*Larger proportion)                ***P1*** | | | | | | | | | | | | | | | | | | |
| ***P2*** | ***10%*** | ***15%*** | ***20%*** | ***25%*** | ***30%*** | ***35%*** | ***40%*** | ***45%*** | ***50%*** | ***55%*** | ***60%*** | ***65%*** | ***70%*** | ***75%*** | ***80%*** | ***85%*** | ***90%*** | ***95%*** | ***100%*** |
| ***10%*** |  | **914** | **263** | **130** | **79** | **53** | **39** | **29** | **22** | **18** | **14** | **11** | **9** | **7** | **5** | **4** | **3** | **2** | **1** |
| ***15%*** |  |  | **1209** | **331** | **158** | **93** | **62** | **44** | **32** | **25** | **19** | **15** | **12** | **9** | **7** | **5** | **4** | **3** | **2** |
| ***20%*** |  |  |  | **1461** | **389** | **181** | **105** | **69** | **48** | **35** | **26** | **20** | **16** | **12** | **9** | **7** | **5** | **4** | **3** |
| ***25%*** |  |  |  |  | **1671** | **436** | **200** | **114** | **74** | **51** | **37** | **27** | **21** | **16** | **12** | **9** | **7** | **5** | **4** |
| ***30%*** |  |  |  |  |  | **1839** | **473** | **214** | **121** | **77** | **53** | **38** | **28** | **21** | **16** | **12** | **9** | **6** | **5** |
| ***35%*** |  |  |  |  |  |  | **1965** | **499** | **223** | **125** | **79** | **53** | **38** | **27** | **20** | **15** | **11** | **8** | **6** |
| ***40%*** |  |  |  |  |  |  |  | **2050** | **515** | **228** | **126** | **79** | **53** | **37** | **26** | **19** | **14** | **10** | **7** |
| ***45%*** |  |  |  |  |  |  |  |  | **2092** | **520** | **228** | **125** | **77** | **51** | **35** | **25** | **18** | **12** | **9** |
| ***50%*** |  |  |  |  |  |  |  |  |  | **2092** | **515** | **223** | **121** | **74** | **48** | **32** | **22** | **15** | **11** |
| ***55%*** |  |  |  |  |  |  |  |  |  |  | **2050** | **499** | **214** | **114** | **69** | **44** | **29** | **19** | **13** |
| ***60%*** |  |  |  |  |  |  |  |  |  |  |  | **1965** | **473** | **200** | **105** | **62** | **39** | **25** | **16** |
| ***65%*** |  |  |  |  |  |  |  |  |  |  |  |  | **1839** | **436** | **181** | **93** | **53** | **32** | **20** |
| ***70%*** |  |  |  |  |  |  |  |  |  |  |  |  |  | **1671** | **389** | **158** | **79** | **43** | **25** |
| ***75%*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **1461** | **331** | **130** | **62** | **32** |
| ***80%*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **1209** | **263** | **97** | **42** |
| ***85%*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **914** | **184** | **60** |
| ***90%*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **578** | **95** |
| ***95%*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **200** |
| ***100%*** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |