KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN MATEMATIK, SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR

**SESI I : 2026/2027**

# DBM30263: STATISTICS & PROBABILITY

**TARIKH : 04 NOVEMBER 2026**
**MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)**

---

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

---

**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

TERBUKA

**INSTRUCTION:**
This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

***ARAHAN:***
*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

**QUESTION 1**
***SOALAN 1***

CLO1 (a) Identify **TWO (2)** types of random variable with an example for each type.
*Kenalpasti **DUA (2)** jenis pembolehubah rawak dengan satu contoh bagi setiap jenis.*

[4 marks]
*[4 markah]*

CLO1 (b) A customer service centre tracks the number of technical referrals a single agent receives per hour. Table 1 shows data collected over 200 operational hours.
*Sebuah pusat khidmat pelanggan memantau bilangan kes rujukan teknikal yang diterima oleh seorang ejen bagi setiap jam. Jadual 1 menunjukkan data yang dikumpul selama 200 jam waktu operasi.*

Table 1/ *Jadual 1*

| Number of Referrals per Hour ($x$)<br>*Bilangan Kes Rujukan Per Jam ($x$)* | Frequency (Hours)<br>*Kekerapan (Jam)* |
|---|---|
| 0 | 110 |
| 1 | 60 |
| 2 | 20 |
| 3 | 10 |

TERBUKA

i. Construct a probability distribution table for data given.
*Bina jadual taburan kebarangkalian bagi data yang diberikan.*

[4 marks]
[*4 markah*]

ii. Calculate the mean(μ) and standard deviation($\sigma$) of the data sets.
*Kirakan min* (μ) *dan sisihan piawai* ($\sigma$) *bagi set data tersebut.*

[7 marks]
*[7 markah]*

CLO1 (c)

i. A pharmaceutical company develops a drug with an 80% success rate in curing a specific disease. If a doctor administers this drug to a random sample of 5 patients, calculate the probability that exactly 4 patients are cured.
*Sebuah syarikat farmasutikal menghasilkan ubat yang mempunyai kadar kejayaan 80% untuk menyembuhkan sejenis penyakit. Jika seorang doctor memberikan ubat ini kepada satu sampel rawak yang terdiri daripada 5 orang pesakit , kira kebarangkalian bahawa tepat 4 orang pesakit akan sembuh.*

[3 marks]
*[3 markah]*

ii. An electronics factory produces high-speed smart routers for home mesh networks. However, each router has a 5% chance of being defective. A randomly sampled 5 routers are selected for stress testing. Calculate the probability that at most 2 routers are defective.
*Sebuah kilang elektronik menghasilkan penghala pintar berkelajuan tinggi untuk rangkaian rumah. Namun demikian, setiap penghala mempunyai 5% peluang untuk rosak. Sampel secara rawak sebanyak 5 buah penghala untuk ujian tekanan. Kirakan kebarangkalian bahawa paling banyak 2 buah penghala didapati rosak.*

TERBUKA

[7 marks]
*[7 markah]*

**QUESTION 2**

***SOALAN 2***

CLO1 (a)

i. Diagram 1 shows two normal distribution curves representing two different datasets, A and B. Both curves have the same mean ($\mu$) but different standard deviation $\sigma$. Determine the curve with the smaller standard deviation, including justification based on the shape of the curve.

*Rajah 1 menunjukkan dua lengkung taburan normal yang mewakili dua set data yang berbeza, iaitu A dan B. Kedua-dua lengkung mempunyai nilai min ($\mu$) yang sama tetapi sisihan piawai ($\sigma$) yang berbeza. Tentukan lengkung yang mempunyai sisihan piawai ($\sigma$) yang lebih kecil, termasuk justifikasi berdasarkan bentuk lengkung tersebut.*

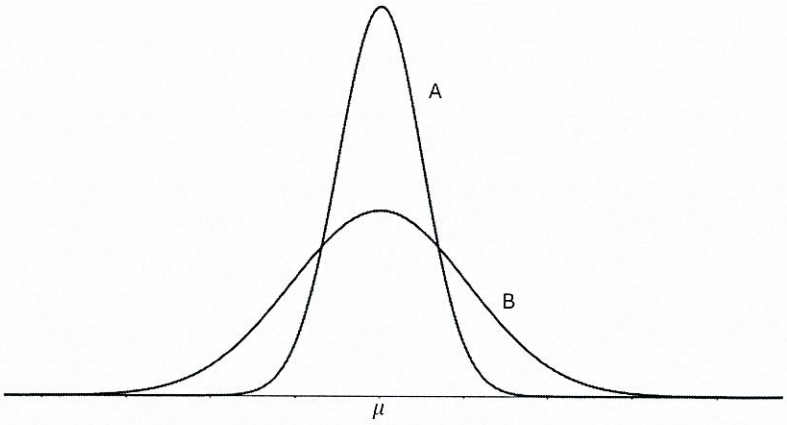


Diagram 1/ *Rajah 1*

[3 marks]

*[3 markah]*

TERBUKA

ii. The lifespan of a specific model of enterprise Solid State Drives (SSD) used in network-attached storage (NAS) is normally distributed with a mean, $\mu = 65$ months and a standard deviation $\sigma = 3$ months.
An IT manager wants to establish a hardware refresh cycle that safely covers approximately 95% of the drives before widespread failure occurs. Construct the appropriate bell-shape graph with the operational month range that represents this 95% threshold which falls between $\mu \pm 2\sigma$ (According to Empirical Rule).
*Jangka hayat bagi model Pemacu Keadaan Pepejal (SSD) perusahaan tertentu yang digunakan dalam storan rangkaian (NAS) adalah bertabur secara normal dengan min, $\mu = 65$ bulan dan sisihan piawai $\sigma = 3$ bulan.*
*Seorang pengurus IT ingin menetapkan kitaran penggantian perkakasan yang merangkumi anggaran 95% pemacu sebelum kerosakan menyeluruh berlaku. Bina graf loceng yang sesuai berdasarkan julat bulan operasi yang mewakili julat 95% ini. Yang mana berada diantara $\mu \pm 2\sigma$ (merujuk kepada Hukum Empirikal).*

[7 marks]
*[7 markah]*

CLO1 (b) The size of weekly log files generated by an enterprise application is normally distributed with a mean of $300\ MB$ and a standard deviation of $40\ MB$. Calculate the probability that the size of a weekly log file is:
*Saiz fail log mingguan yang dihasilkan oleh aplikasi perusahaan bertabur secara normal dengan min $300\ MB$ dan sisihan piawai $40\ MB$. Kira kebarangkalian saiz fail log mingguan adalah:*

i. less than $240MB$
*kurang daripada $240MB$*

TERBUKA

[3 marks]
*[3 markah]*

ii. more than $350MB$
*lebih daripada* $350MB$

[5 marks]
*[5 markah]*

iii. if cloud storage for these logs is capped at 380 MB per week, determine the percentage of weeks in which log file generation will overflow the allocated limit with an appropriate justification.
*jika penyimpanan awan untuk log ini dibatasi 380 MB setiap minggu, Tentukan peratusan minggu yang mengalami lonjakan log yang melebihi batas tersebut dengan huraian dapat yang diperolehi.*

[7 marks]
*[7 markah]*

TERBUKA

**QUESTION 3**
***SOALAN 3***

CLO1 (a) A data center virtual machine has a 90% probability of successfully running an automated backup script without errors. During a routine audit, a sample of 150 scripts is tested independently with standard deviation of 3.674.
*Sebuah mesin maya pusat data mempunyai kebarangkalian 90% untuk berjaya menjalankan skrip sandaran automatik tanpa ralat. Semasa audit rutin, sampel sebanyak 150 skrip diuji secara bebas dengan sisihan piawai sebanyak 3.674*

i. Show that the conditions required to approximate the binomial distribution with normal distribution are met for the audit.
*Tunjukkan bahawa syarat-syarat yang diperlukan untuk menganggarkan taburan binomial dengan taburan normal adalah dipenuhi bagi audit ini.*

[3 marks]
*[3 markah]*

ii. Calculate the probability of obtaining between 135 and 142 successful scripts run. (Use the continuity correction to solve the problem)
*Hitung kebarangkalian untuk memperoleh antara 135 hingga 142 pelaksanaan skrip yang berjaya. (Gunakan pembetulan kesinambungan dalam menyelesaiaan masalah)*

[7 marks]
*[7 markah]*

CLO1 (b) An online shopping application relies on a digital payment system. Based on transaction logs history, 5% of all payment attempts failed due to network congestion. To review system performance during a flash sale day, a random sample of 600 transaction attempts were selected for evaluation. Using the normal approximation to the binomial distribution, answer the following questions:
*Sebuah aplikasi dalam talian bergantung kepada sistem pembayaran digital. Berdasarkan sejarah log transaksi, 5% daripada semua cubaan pembayaran gagal disebabkan oleh kesesakan rangkaian. Untuk menyemak prestasi sistem semasa hari jualan kilat, satu sampel rawak sebanyak 600 cubaan transaksi telah dipilih untuk dinilai.*

i. Calculate the mean and standard deviation of this distribution.
*Kirakan min dan sisihan piawai bagi taburan ini.*

[4 marks]
*[4 markah]*

ii. Calculate the probability that exactly 24 transactions failed.
*Kirakan kebarangkalian bahawa tepat 24 transaksi gagal.*

[7 marks]
*[7 markah]*

TERBUKA

iii. Based on your answer in Question 3(b)(ii), interpret the probability obtained in the context of the number of transactions fail due to network congestion.

*Berdasarkan jawapan anda dalam Soalan 3(b)(ii), tafsirkan kebarangkalian yang diperoleh dalam konteks bilangan pembayaran yang gagal disebabkan oleh kesesakan rangkaian.*

[4 marks]

*[4 markah]*

**QUESTION 4**

***SOALAN 4***

CLO1 (a) An IT department wants to survey students' satisfaction with the campus Wi-Fi service.

*Jabatan Teknologi Maklumat ingin menjalankan kajian mengenai tahap kepuasan pelajar terhadap perkhidmatan Wi-Fi kampus.*

i. Explain the difference between random sampling and non-random sampling.

*Terangkan perbezaan antara pensampelan rawak dan pensampelan bukan rawak.*

[2 marks]

*[2 markah]*

ii. Give **ONE (1)** example of random sampling and non-random sampling in the context of the survey.

*Berikan **SATU (1)** contoh pensampelan rawak pensampelan bukan rawak yang sesuai dalam konteks kajian tersebut.*

TERBUKA

[2 marks]

*[2 markah]*

CLO1 (b)

i. A survey finds that 38 out of 50 Information Technology (IT) students use cloud storage services regularly. Calculate the point estimate of the population proportion of IT students who **DO NOT** use cloud storage services regularly.

*Satu tinjauan mendapati bahawa 38 daripada 50 pelajar Teknologi Maklumat (IT) menggunakan perkhidmatan storan awan secara berkala. Kirakan anggaran titik bagi perkadaran populasi pelajar IT yang* ***TIDAK*** *menggunakan perkhidmatan storan awan secara berkala.*

[3 marks]

*[3 markah]*

ii. The number of hours spent by 6 IT students using the campus Wi-Fi network in a day is: 4.0, 6.5, 5.0, 7.5, 8.0 and 5.5. Calculate the point estimate of the population standard deviation.

*Bilangan jam yang dihabiskan oleh 6 pelajar IT menggunakan rangkaian Wi-Fi kampus dalam sehari ialah:* 4.0, 6.5, 5.0, 7.5, 8.0 *dan* 5.5. *Kirakan anggaran titik bagi sisihan piawai populasi.*

[7 marks]

*[7 markah]*

TERBUKA

CLO1 (c) The Polytechnic IT Department wants to estimate the average weekly time spent by students using the Learning Management System (LMS). A random sample of 100 students was selected. The following information was obtained:

- Sample mean, $\bar{x}$ = 12.5 hours
- Population standard deviation, $\sigma$ = 3.2 hours

*Jabatan Teknologi Maklumat sebuah politeknik ingin menganggarkan purata masa yang digunakan oleh pelajar untuk menggunakan Sistem Pengurusan Pembelajaran (LMS) setiap minggu. Satu sampel rawak sebanyak 100 orang pelajar telah dipilih. Maklumat berikut diperoleh:*

- *Min sampel, $\bar{x}$ = 12.5 jam*
- *Sisihan piawai populasi, $\sigma$ = 3.2 jam*

Using a 95% confidence level:

*Dengan menggunakan aras keyakinan 95%*

i. calculate the standard error of the mean.
*kirakan ralat piawai bagi min.*

[2 marks]
*[2 markah]*

ii. calculate the margin of error.
*kirakan ralat margin.*

[3 marks]
*[3 markah]*

iii. determine the 95% confidence interval for the population mean with the interpretation of the confidence interval obtained.
*tentukan selang keyakinan 95% bagi min populasi. dengan huraian hasil dapatan selang keyakinan yang diperoleh.*

[6 marks]
*[6 markah]*

TERBUKA

**SOALAN TAMAT**

**FORMULA SHEET FOR DBM30263: STATISTICS AND PROBABILITY**

<table>
<tr><th colspan="4">PROBABILITY DISTRIBUTIONS</th></tr>
<tr><td>1</td><td>Mean of a Discrete Random Variable<br><br>$\mu = E(x) = \sum [x \cdot P(X = x)]$</td><td>6</td><td>Standard Normal Distribution<br><br>$z = \frac{X - \mu}{\sigma}$<br><br>Where;<br>$X \sim N(\mu, \sigma^2)$</td></tr>
<tr><td>2</td><td>Variance of a Discrete Random Variable<br><br>$\sigma^2 = \sum [(x - \mu)^2 \cdot P(X = x)]$<br>Or<br>$\sigma^2 = \left[\sum x^2 . P(X = x)\right] - \mu^2$</td><td>7</td><td rowspan="4">Continuity Correction<br>i. $P(X \geq a) = P(X > a - 0.5)$<br>ii. $P(X > a) = P(X > a + 0.5)$<br>iii. $P(X \leq a) = P(X < a + 0.5)$<br>iv. $P(X < a) = P(X < a - 0.5)$<br>v. $P(a \leq X \leq b) = P(a - 0.5 < X < b + 0.5)$<br>vi. $P(a < X < b) = P(a + 0.5 < X < b - 0.5)$<br>vii. $P(X = a) = P(a - 0.5 < X < a + 0.5)$</td></tr>
<tr><td>3</td><td>Standard Deviation of a Discrete Random Variable<br><br>$\sigma = \sqrt{\text{Variance}}$</td><td></td></tr>
<tr><td>4</td><td>Binomial Distributions<br><br>$P(X = x) = \frac{n!}{(n - x)!\, x!} \cdot p^x \cdot q^{n-x}$<br>Or<br>$P(X = x) = {}^nC_x \cdot p^x \cdot q^{n-x}$<br><br>Where;<br>$X \sim B(n, p)$<br>$q = 1 - p$</td><td></td></tr>
<tr><td>5</td><td>Mean, Variance, and Standard Deviation of Binomial Distribution<br><br>Mean, $\mu = np$<br>Variance, $\sigma^2 = npq$<br>Standard Deviation, $\sigma = \sqrt{\text{Variance}}$</td><td></td></tr>
</table>

| SAMPLING AND ESTIMATION | | | |
|---|---|---|---|
| 1 | Point Estimate for Population Mean, ($\mu$)<br>(Sample Mean): $\bar{x} = \frac{\sum x}{n}$ | 6 | Critical t-value<br>$t_{\alpha/2}$ |
| 2 | Population Proportion ($\hat{p}$)<br>(Sample Proportion): $\hat{p} = \frac{x}{n}$ | 7 | Degree of Freedom<br>$df = n - 1$ |
| 3 | Population Standard Deviation ($\sigma$)<br>(Sample Standard Deviation):<br>$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$ | 8 | Confidence Interval of a Population Mean for Large Samples<br>$CI = \bar{x} \pm ME$<br>Where;<br>$ME = z_{\alpha/2} \cdot \left(\frac{\sigma}{\sqrt{n}}\right)$ |
| 4 | Standard Error of The Mean<br>$SEM = \frac{\sigma}{\sqrt{n}}$ | 9 | Confidence Interval of a Population Mean for Small Samples<br>$CI = \bar{x} \pm ME$<br>Where;<br>$ME = t_{\alpha/2} \cdot \left(\frac{s}{\sqrt{n}}\right)$ |
| 5 | Critical z-value<br>$z_{\alpha/2}$ | 10 | Confidence Interval of a Population Proportion for Large Samples<br>$CI = \hat{p} \pm ME$<br>Where;<br>$ME = z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$ |

# Standard Normal Probabilities

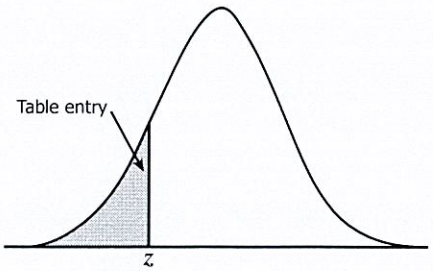


Table entry for $z$ is the area under the standard normal curve to the left of $z$.

| $z$ | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| −3.4 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0002 |
| −3.3 | .0005 | .0005 | .0005 | .0004 | .0004 | .0004 | .0004 | .0004 | .0004 | .0003 |
| −3.2 | .0007 | .0007 | .0006 | .0006 | .0006 | .0006 | .0006 | .0005 | .0005 | .0005 |
| −3.1 | .0010 | .0009 | .0009 | .0009 | .0008 | .0008 | .0008 | .0008 | .0007 | .0007 |
| −3.0 | .0013 | .0013 | .0013 | .0012 | .0012 | .0011 | .0011 | .0011 | .0010 | .0010 |
| −2.9 | .0019 | .0018 | .0018 | .0017 | .0016 | .0016 | .0015 | .0015 | .0014 | .0014 |
| −2.8 | .0026 | .0025 | .0024 | .0023 | .0023 | .0022 | .0021 | .0021 | .0020 | .0019 |
| −2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |
| −2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| −2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0054 | .0052 | .0051 | .0049 | .0048 |
| −2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| −2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| −2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| −2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| −2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| −1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | .0250 | .0244 | .0239 | .0233 |
| −1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| −1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| −1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| −1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| −1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| −1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |
| −1.2 | .1151 | .1131 | .1112 | .1093 | .1075 | .1056 | .1038 | .1020 | .1003 | .0985 |
| −1.1 | .1357 | .1335 | .1314 | .1292 | .1271 | .1251 | .1230 | .1210 | .1190 | .1170 |
| −1.0 | .1587 | .1562 | .1539 | .1515 | .1492 | .1469 | .1446 | .1423 | .1401 | .1379 |
| −0.9 | .1841 | .1814 | .1788 | .1762 | .1736 | .1711 | .1685 | .1660 | .1635 | .1611 |
| −0.8 | .2119 | .2090 | .2061 | .2033 | .2005 | .1977 | .1949 | .1922 | .1894 | .1867 |
| −0.7 | .2420 | .2389 | .2358 | .2327 | .2296 | .2266 | .2236 | .2206 | .2177 | .2148 |
| −0.6 | .2743 | .2709 | .2676 | .2643 | .2611 | .2578 | .2546 | .2514 | .2483 | .2451 |
| −0.5 | .3085 | .3050 | .3015 | .2981 | .2946 | .2912 | .2877 | .2843 | .2810 | .2776 |
| −0.4 | .3446 | .3409 | .3372 | .3336 | .3300 | .3264 | .3228 | .3192 | .3156 | .3121 |
| −0.3 | .3821 | .3783 | .3745 | .3707 | .3669 | .3632 | .3594 | .3557 | .3520 | .3483 |
| −0.2 | .4207 | .4168 | .4129 | .4090 | .4052 | .4013 | .3974 | .3936 | .3897 | .3859 |
| −0.1 | .4602 | .4562 | .4522 | .4483 | .4443 | .4404 | .4364 | .4325 | .4286 | .4247 |
| −0.0 | .5000 | .4960 | .4920 | .4880 | .4840 | .4801 | .4761 | .4721 | .4681 | .4641 |

# Standard Normal Probabilities

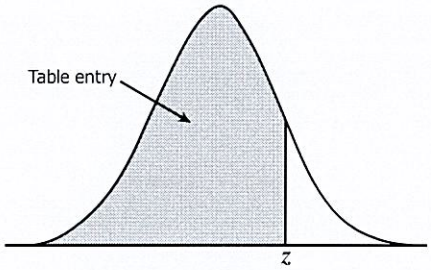


Table entry for $z$ is the area under the standard normal curve to the left of $z$.

| $z$ | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .5000 | .5040 | .5080 | .5120 | .5160 | .5199 | .5239 | .5279 | .5319 | .5359 |
| 0.1 | .5398 | .5438 | .5478 | .5517 | .5557 | .5596 | .5636 | .5675 | .5714 | .5753 |
| 0.2 | .5793 | .5832 | .5871 | .5910 | .5948 | .5987 | .6026 | .6064 | .6103 | .6141 |
| 0.3 | .6179 | .6217 | .6255 | .6293 | .6331 | .6368 | .6406 | .6443 | .6480 | .6517 |
| 0.4 | .6554 | .6591 | .6628 | .6664 | .6700 | .6736 | .6772 | .6808 | .6844 | .6879 |
| 0.5 | .6915 | .6950 | .6985 | .7019 | .7054 | .7088 | .7123 | .7157 | .7190 | .7224 |
| 0.6 | .7257 | .7291 | .7324 | .7357 | .7389 | .7422 | .7454 | .7486 | .7517 | .7549 |
| 0.7 | .7580 | .7611 | .7642 | .7673 | .7704 | .7734 | .7764 | .7794 | .7823 | .7852 |
| 0.8 | .7881 | .7910 | .7939 | .7967 | .7995 | .8023 | .8051 | .8078 | .8106 | .8133 |
| 0.9 | .8159 | .8186 | .8212 | .8238 | .8264 | .8289 | .8315 | .8340 | .8365 | .8389 |
| 1.0 | .8413 | .8438 | .8461 | .8485 | .8508 | .8531 | .8554 | .8577 | .8599 | .8621 |
| 1.1 | .8643 | .8665 | .8686 | .8708 | .8729 | .8749 | .8770 | .8790 | .8810 | .8830 |
| 1.2 | .8849 | .8869 | .8888 | .8907 | .8925 | .8944 | .8962 | .8980 | .8997 | .9015 |
| 1.3 | .9032 | .9049 | .9066 | .9082 | .9099 | .9115 | .9131 | .9147 | .9162 | .9177 |
| 1.4 | .9192 | .9207 | .9222 | .9236 | .9251 | .9265 | .9279 | .9292 | .9306 | .9319 |
| 1.5 | .9332 | .9345 | .9357 | .9370 | .9382 | .9394 | .9406 | .9418 | .9429 | .9441 |
| 1.6 | .9452 | .9463 | .9474 | .9484 | .9495 | .9505 | .9515 | .9525 | .9535 | .9545 |
| 1.7 | .9554 | .9564 | .9573 | .9582 | .9591 | .9599 | .9608 | .9616 | .9625 | .9633 |
| 1.8 | .9641 | .9649 | .9656 | .9664 | .9671 | .9678 | .9686 | .9693 | .9699 | .9706 |
| 1.9 | .9713 | .9719 | .9726 | .9732 | .9738 | .9744 | .9750 | .9756 | .9761 | .9767 |
| 2.0 | .9772 | .9778 | .9783 | .9788 | .9793 | .9798 | .9803 | .9808 | .9812 | .9817 |
| 2.1 | .9821 | .9826 | .9830 | .9834 | .9838 | .9842 | .9846 | .9850 | .9854 | .9857 |
| 2.2 | .9861 | .9864 | .9868 | .9871 | .9875 | .9878 | .9881 | .9884 | .9887 | .9890 |
| 2.3 | .9893 | .9896 | .9898 | .9901 | .9904 | .9906 | .9909 | .9911 | .9913 | .9916 |
| 2.4 | .9918 | .9920 | .9922 | .9925 | .9927 | .9929 | .9931 | .9932 | .9934 | .9936 |
| 2.5 | .9938 | .9940 | .9941 | .9943 | .9945 | .9946 | .9948 | .9949 | .9951 | .9952 |
| 2.6 | .9953 | .9955 | .9956 | .9957 | .9959 | .9960 | .9961 | .9962 | .9963 | .9964 |
| 2.7 | .9965 | .9966 | .9967 | .9968 | .9969 | .9970 | .9971 | .9972 | .9973 | .9974 |
| 2.8 | .9974 | .9975 | .9976 | .9977 | .9977 | .9978 | .9979 | .9979 | .9980 | .9981 |
| 2.9 | .9981 | .9982 | .9982 | .9983 | .9984 | .9984 | .9985 | .9985 | .9986 | .9986 |
| 3.0 | .9987 | .9987 | .9987 | .9988 | .9988 | .9989 | .9989 | .9989 | .9990 | .9990 |
| 3.1 | .9990 | .9991 | .9991 | .9991 | .9992 | .9992 | .9992 | .9992 | .9993 | .9993 |
| 3.2 | .9993 | .9993 | .9994 | .9994 | .9994 | .9994 | .9994 | .9995 | .9995 | .9995 |
| 3.3 | .9995 | .9995 | .9995 | .9996 | .9996 | .9996 | .9996 | .9996 | .9996 | .9997 |
| 3.4 | .9997 | .9997 | .9997 | .9997 | .9997 | .9997 | .9997 | .9997 | .9997 | .9998 |

# *t* Table

| cum. prob | $t_{.50}$ | $t_{.75}$ | $t_{.80}$ | $t_{.85}$ | $t_{.90}$ | $t_{.95}$ | $t_{.975}$ | $t_{.99}$ | $t_{.995}$ | $t_{.999}$ | $t_{.9995}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **one-tail** | **0.50** | **0.25** | **0.20** | **0.15** | **0.10** | **0.05** | **0.025** | **0.01** | **0.005** | **0.001** | **0.0005** |
| **two-tails** | **1.00** | **0.50** | **0.40** | **0.30** | **0.20** | **0.10** | **0.05** | **0.02** | **0.01** | **0.002** | **0.001** |
| **df** | | | | | | | | | | | |
| 1 | 0.000 | 1.000 | 1.376 | 1.963 | 3.078 | 6.314 | 12.71 | 31.82 | 63.66 | 318.31 | 636.62 |
| 2 | 0.000 | 0.816 | 1.061 | 1.386 | 1.886 | 2.920 | 4.303 | 6.965 | 9.925 | 22.327 | 31.599 |
| 3 | 0.000 | 0.765 | 0.978 | 1.250 | 1.638 | 2.353 | 3.182 | 4.541 | 5.841 | 10.215 | 12.924 |
| 4 | 0.000 | 0.741 | 0.941 | 1.190 | 1.533 | 2.132 | 2.776 | 3.747 | 4.604 | 7.173 | 8.610 |
| 5 | 0.000 | 0.727 | 0.920 | 1.156 | 1.476 | 2.015 | 2.571 | 3.365 | 4.032 | 5.893 | 6.869 |
| 6 | 0.000 | 0.718 | 0.906 | 1.134 | 1.440 | 1.943 | 2.447 | 3.143 | 3.707 | 5.208 | 5.959 |
| 7 | 0.000 | 0.711 | 0.896 | 1.119 | 1.415 | 1.895 | 2.365 | 2.998 | 3.499 | 4.785 | 5.408 |
| 8 | 0.000 | 0.706 | 0.889 | 1.108 | 1.397 | 1.860 | 2.306 | 2.896 | 3.355 | 4.501 | 5.041 |
| 9 | 0.000 | 0.703 | 0.883 | 1.100 | 1.383 | 1.833 | 2.262 | 2.821 | 3.250 | 4.297 | 4.781 |
| 10 | 0.000 | 0.700 | 0.879 | 1.093 | 1.372 | 1.812 | 2.228 | 2.764 | 3.169 | 4.144 | 4.587 |
| 11 | 0.000 | 0.697 | 0.876 | 1.088 | 1.363 | 1.796 | 2.201 | 2.718 | 3.106 | 4.025 | 4.437 |
| 12 | 0.000 | 0.695 | 0.873 | 1.083 | 1.356 | 1.782 | 2.179 | 2.681 | 3.055 | 3.930 | 4.318 |
| 13 | 0.000 | 0.694 | 0.870 | 1.079 | 1.350 | 1.771 | 2.160 | 2.650 | 3.012 | 3.852 | 4.221 |
| 14 | 0.000 | 0.692 | 0.868 | 1.076 | 1.345 | 1.761 | 2.145 | 2.624 | 2.977 | 3.787 | 4.140 |
| 15 | 0.000 | 0.691 | 0.866 | 1.074 | 1.341 | 1.753 | 2.131 | 2.602 | 2.947 | 3.733 | 4.073 |
| 16 | 0.000 | 0.690 | 0.865 | 1.071 | 1.337 | 1.746 | 2.120 | 2.583 | 2.921 | 3.686 | 4.015 |
| 17 | 0.000 | 0.689 | 0.863 | 1.069 | 1.333 | 1.740 | 2.110 | 2.567 | 2.898 | 3.646 | 3.965 |
| 18 | 0.000 | 0.688 | 0.862 | 1.067 | 1.330 | 1.734 | 2.101 | 2.552 | 2.878 | 3.610 | 3.922 |
| 19 | 0.000 | 0.688 | 0.861 | 1.066 | 1.328 | 1.729 | 2.093 | 2.539 | 2.861 | 3.579 | 3.883 |
| 20 | 0.000 | 0.687 | 0.860 | 1.064 | 1.325 | 1.725 | 2.086 | 2.528 | 2.845 | 3.552 | 3.850 |
| 21 | 0.000 | 0.686 | 0.859 | 1.063 | 1.323 | 1.721 | 2.080 | 2.518 | 2.831 | 3.527 | 3.819 |
| 22 | 0.000 | 0.686 | 0.858 | 1.061 | 1.321 | 1.717 | 2.074 | 2.508 | 2.819 | 3.505 | 3.792 |
| 23 | 0.000 | 0.685 | 0.858 | 1.060 | 1.319 | 1.714 | 2.069 | 2.500 | 2.807 | 3.485 | 3.768 |
| 24 | 0.000 | 0.685 | 0.857 | 1.059 | 1.318 | 1.711 | 2.064 | 2.492 | 2.797 | 3.467 | 3.745 |
| 25 | 0.000 | 0.684 | 0.856 | 1.058 | 1.316 | 1.708 | 2.060 | 2.485 | 2.787 | 3.450 | 3.725 |
| 26 | 0.000 | 0.684 | 0.856 | 1.058 | 1.315 | 1.706 | 2.056 | 2.479 | 2.779 | 3.435 | 3.707 |
| 27 | 0.000 | 0.684 | 0.855 | 1.057 | 1.314 | 1.703 | 2.052 | 2.473 | 2.771 | 3.421 | 3.690 |
| 28 | 0.000 | 0.683 | 0.855 | 1.056 | 1.313 | 1.701 | 2.048 | 2.467 | 2.763 | 3.408 | 3.674 |
| 29 | 0.000 | 0.683 | 0.854 | 1.055 | 1.311 | 1.699 | 2.045 | 2.462 | 2.756 | 3.396 | 3.659 |
| 30 | 0.000 | 0.683 | 0.854 | 1.055 | 1.310 | 1.697 | 2.042 | 2.457 | 2.750 | 3.385 | 3.646 |
| 40 | 0.000 | 0.681 | 0.851 | 1.050 | 1.303 | 1.684 | 2.021 | 2.423 | 2.704 | 3.307 | 3.551 |
| 60 | 0.000 | 0.679 | 0.848 | 1.045 | 1.296 | 1.671 | 2.000 | 2.390 | 2.660 | 3.232 | 3.460 |
| 80 | 0.000 | 0.678 | 0.846 | 1.043 | 1.292 | 1.664 | 1.990 | 2.374 | 2.639 | 3.195 | 3.416 |
| 100 | 0.000 | 0.677 | 0.845 | 1.042 | 1.290 | 1.660 | 1.984 | 2.364 | 2.626 | 3.174 | 3.390 |
| 1000 | 0.000 | 0.675 | 0.842 | 1.037 | 1.282 | 1.646 | 1.962 | 2.330 | 2.581 | 3.098 | 3.300 |
| ***z*** | 0.000 | 0.674 | 0.842 | 1.036 | 1.282 | 1.645 | 1.960 | 2.326 | 2.576 | 3.090 | 3.291 |
| | 0% | 50% | 60% | 70% | 80% | 90% | 95% | 98% | 99% | 99.8% | 99.9% |
| | **Confidence Level** | | | | | | | | | | |