Cardiff Business School
Cardiff University

Ysgol Fusnes Caerdydd
Prifysgol Caerdydd

CARDIFF UNIVERSITY
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# Applied Statistics and Mathematics in Economics & Business

## BS1501

# Tutorial 2

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# 1. Mutually Exclusive?

(a) Being an economist and being a professor:
Not mutually exclusive

(b) Throwing a 5 or 6 with one die:
Mutually exclusive

(c) Being an M.P. and being 20 years of age. (Minimum age of an M.P. is 21):
Mutually exclusive

(d) Drawing a red card or an ace out of a pack of cards:
Not mutually exclusive

# 2.Accountancy employees

(a) Prob. of employees from Wales: **P(W)**
= from Wales / All employees
= **6/15**

(b) Prob. of employees Scotland: P(S)
= from Scotland / All employees
= **4/15**

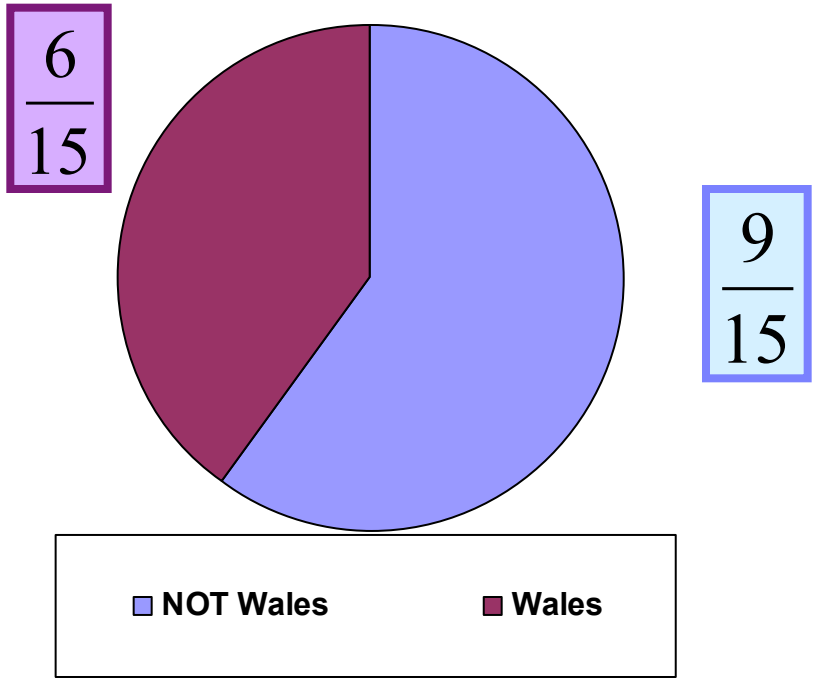
# 2.Accountancy employees

(c) Prob. of employees **NOT** from Wales:

=All prob. – P(W)

= 1 – P(W)

= 1-(6/15) = **9/15**



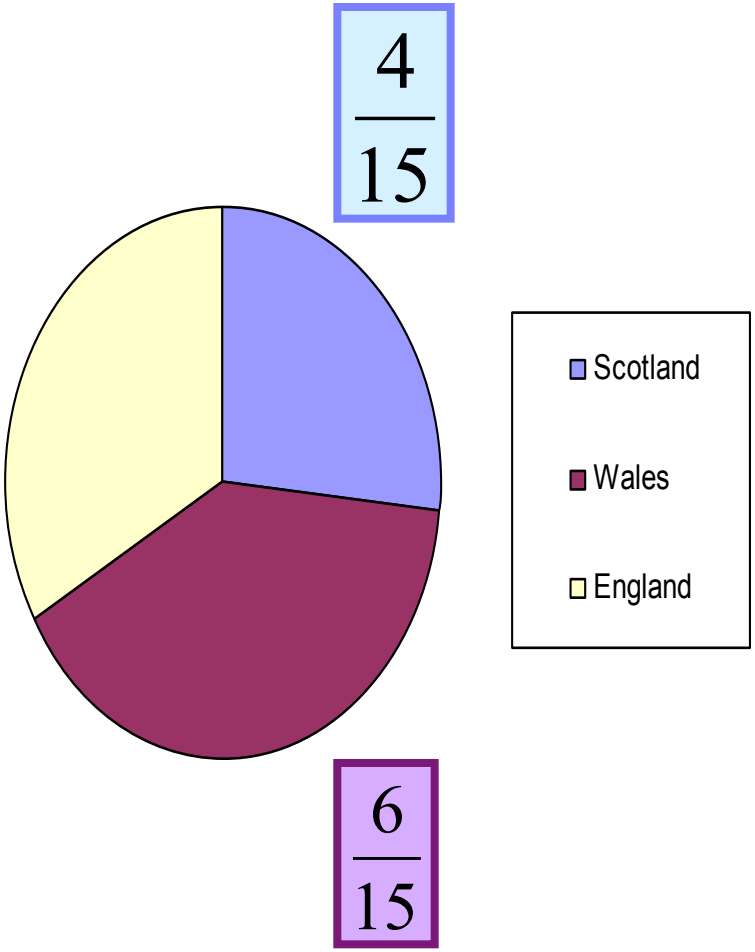
# 2.Accountancy employees

(d) Prob. of employees From Wales and Scotland

= P(W) + P(S)

= (6/15) + (4/15)

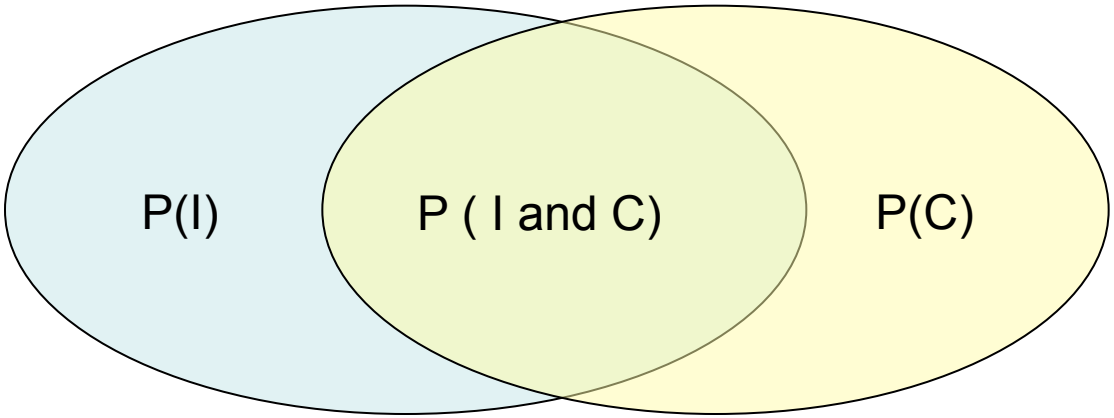
= **10/15**



# 3. Primary school in Cardiff

I = the event that the boy likes ice-cream
C = the event that the boy likes cake

P(I) = 0.75, P(C) = 0.55, P (I and C) = 0.40




(a) P(I or C or both) = P(I) + P(C) – P(I and C)
= 0.75 + 0.55 – 0.40 = 0.90

# 3. Primary school in Cardiff

I = the event that the boy likes ice-cream

C = the event that the boy likes cake

P(I) = 0.75, P(C) = 0.55, P (I and C) = 0.40

(b) Neither ice-cream nor cake

= 1 – P(I or C or Both)

= 1- 0.90

= 0.1

# 4. Accidents

| | Accident | No accident |
|---|---|---|
| **Under 45 years** | 25 | 35 |
| **45 years or older** | 5 | 35 |

# 4. Accidents

| | Accident | No accident | Total |
|---|---|---|---|
| **Under 45 years** | 25 | 35 | 60<br>*(25 + 35)* |
| **45 years or older** | 5 | 35 | 40<br>*(5 + 35)* |
| **Total** | 30<br>*(25 + 5)* | 70<br>*(35 + 35)* | 100 |

# 4. Accidents

(a)

| | Accident | No accident | Total |
|---|---|---|---|
| **Under 45 years** | 0.25 (25/100) | 0.35 (35/100) | 0.60 (60/100) |
| **45 years or older** | 0.05 (5/100) | 0.35 (35/100) | 0.40 (40/100) |
| **Total** | 0.30 (30/100) | 0.70 (70/100) | 1.0 (100/100) |

# 4. Accidents

(b) P(Accident | under 45)

= P(Accident and under 45) / P(Under 45)

= 0.25 / 0.60 = **0.416**

| | Accident | No accident | Total |
|---|---|---|---|
| **Under 45 years** | **0.25** **(25/100)** | **0.35** **(35/100)** | **0.60** **([25+35]/100)** |
| **45 years or older** | **0.05** **(5/100)** | **0.35** **(35/100)** | **0.40** **(40/100)** |
| **Total** | **0.30** **(30/100)** | **0.70** **(70/100)** | **1.0** **(100/100)** |

# 4. Accidents

(c) P( Accident | over 45)

= P(Accident and over 45) / P(over 45)

= 0.05 / 0.40 = **0.125**

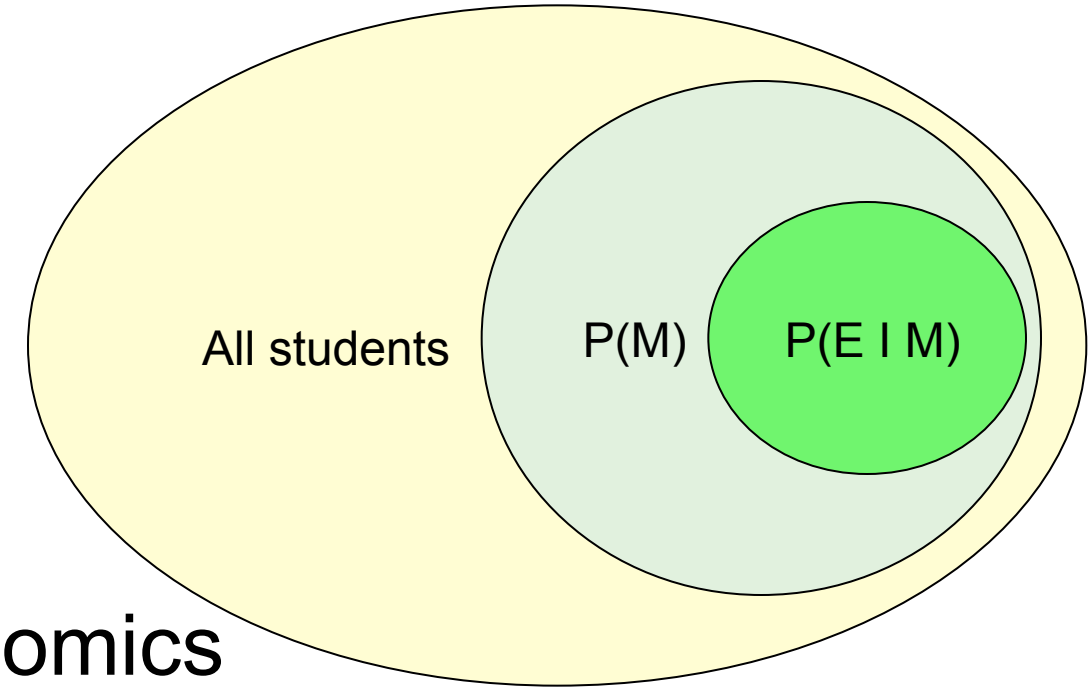
| | Accident | No accident | Total |
|---|---|---|---|
| **Under 45 years** | **0.25 (25/100)** | **0.35 (35/100)** | **0.60 ([25+35]/100)** |
| **45 years or older** | **0.05 (5/100)** | **0.35 (35/100)** | **0.40 (40/100)** |
| **Total** | **0.30 (30/100)** | **0.70 (70/100)** | **1.0 (100/100)** |

# 5. Economics course

*P(M) = P(F) =1/2*

*P(E | M) = 1/6*

*P(E | F) = 1/30*



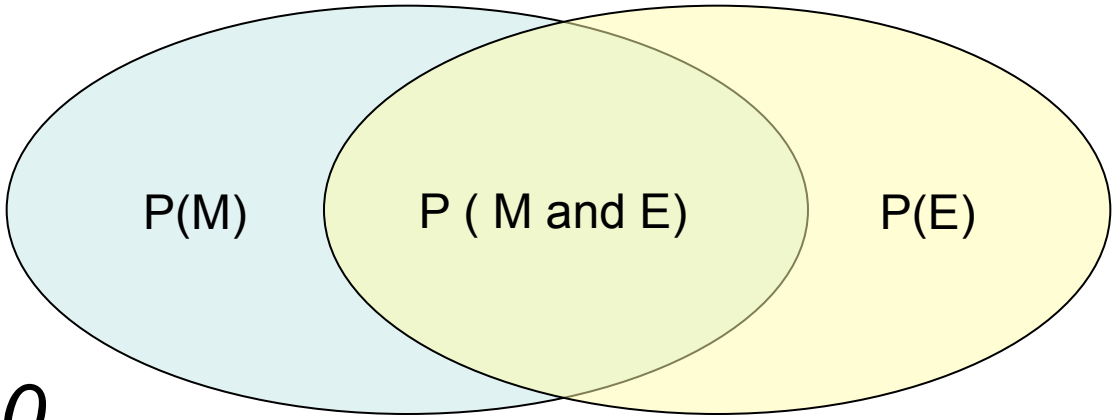

(a) Male and Economics

P(M and E) = P(E | M) * P(M)

= (1/6)*(1/2) = 1/12

# 5. Economics course

*P(M) = P(F) =1/2*
*P(E | M) = 1/6*
*P(E | F) = 1/30*




*P(E) = 10% = 1/10*

(b) **P(M or E)** = P(M) + P(E) – P(M and E)
= (1/2) + (1/10) – (1/12)
= **31/60**

# 6. Financial advisor

**Combination:**
Number of ways of selecting x object from a set of n, when the order in unimportant

$$\binom{n}{x} = \frac{n!}{x!(n-x)!}$$

n = 10

x = 4

(n-x) = 6

$$\binom{10}{4} = \frac{10!}{4!6!} = \frac{10*9*8*7*6!}{4!6!}$$

$$= \frac{10*9*8*7}{(4*3*2*1)}$$

$$= \frac{10*(3*3)*8*7}{(8*3)} = \frac{10*3*7}{1} = 210$$

# 7. Company's Demand

| Weekly unit Demand (x) | Probability: f(x) | E (x) = x*f(x) | x – E (x) | [x-E(x)]^2*f(x) |
|---|---|---|---|---|
| 800 | 0.10 | 80.00 | -185.00 | 3422.50 |
| 900 | 0.25 | 225.00 | -85.00 | 1806.25 |
| 1000 | 0.40 | 400.00 | 15.00 | 90.00 |
| 1100 | 0.20 | 220.00 | 115.00 | 2645.00 |
| 1200 | 0.05 | 60.00 | 215.00 | 2311.25 |
| **Sum** | **Expected value** | **985.00** | **Variance** | **10275.00** |
| | | | **Std Deviation** | **101.37** |

# 7. Company's Demand

(a) E(x) = Sum [x*f(x)]

= 800(0.10) + 900(0.25) +
1000(0.40) + 1100(0.20) + 1200(0.05)

= 985

(b) Var(x) = Sum [(x-E(x)^2)*f(x)]

= (800-985)^2(0.10) + (900 -985)^2(0.25)
+ (1000-985)^2(0.40)+(1100-985)^2(0.20)
+(1200-985)^2(0.05)

= 10,275

Standard deviation = sqrt(10,275) = 101.36

# 8. Insurance Salesperson

$$P(x) = \binom{n}{x}[p(x)]^x[1-p(x)]^{n-x}$$

(a) $P(x=6) = \binom{6}{6}(2/3)^6(1/3)^0 = 0.088$

$$\binom{n}{x} = \frac{n!}{x!(n-x)!}$$

(b) $P(x=4) = \binom{6}{4}(2/3)^4(1/3)^2 = 0.329$

# 8. Insurance Salesperson

$$P(x) = \binom{n}{x}[p(x)]^x[1-p(x)]^{n-x} \qquad \binom{n}{x} = \frac{n!}{x!(n-x)!}$$

(c) $P(x > 1) = 1 - [P(x = 0) + P(x = 1)]$

$$P(x = 0) = \binom{6}{0}(2/3)^0(1/3)^6 \qquad P(x = 1) = \binom{6}{1}(2/3)^1(1/3)^5$$

$$= 1 - 0.02$$

$$= 0.98$$

(d) $\mu = np = 6(2/3) = 4$

# 9. Fatal Rate

**Poisson Distribution:**

Estimating the number of occurrence of an event within specific interval of time

A) No death in a one year period

x = 0

$$\lambda(1 year) = 1.5$$

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$P(x = 0) = \frac{\lambda^x e^{-\lambda}}{x!} = \frac{1.5^0 e^{-1.5}}{0!} = 0.2231$$

# 9. Fatal Rate

**Poisson Distribution:**

Estimating the number of occurrence of an event within specific interval of time

b) No death in 6 months period

x = 0

$$\lambda(6months) = 1.5/2 = 0.75$$

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!} \qquad P(x=0) = \frac{0.75^0 e^{-0.75}}{0!} = 0.4724$$

# 9. Fatal Rate

c) P(>= 2 accidents in 6 months)

$$\lambda(6months) = 0.75$$

= 1 – P (x=0) – P (x=1)

= 1 – 0.4724 – 0.3543

**= 0.1733**

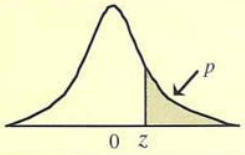
# 10. Train (Cardiff – London)

(a) $x \sim N(\mu = 120, \sigma = 10)$ $P(x > x_0) = p\left(Z > \dfrac{x_0 - \mu}{\sigma}\right)$

$$P(x > 130) = p\left(Z \geq \frac{130 - 120}{10}\right)$$

$$= P(Z > +1)$$

$$= 0.1586$$




| | Second decimal place of $z$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $z$ | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
| 0.0 | .5000 | .4960 | .4920 | .4880 | .4840 | .4801 | .4761 | .4721 | .4681 | .4641 |
| 0.1 | .4602 | .4562 | .4522 | .4483 | .4443 | .4404 | .4364 | .4325 | .4286 | .4247 |
| 0.2 | .4207 | .4168 | .4129 | .4090 | .4052 | .4013 | .3974 | .3936 | .3897 | .3859 |
| 0.3 | .3821 | .3783 | .3745 | .3707 | .3669 | .3632 | .3594 | .3557 | .3520 | .3483 |
| 0.4 | .3446 | .3409 | .3372 | .3336 | .3300 | .3264 | .3228 | .3192 | .3156 | .3121 |
| 0.5 | .3085 | .3050 | .3015 | .2981 | .2946 | .2912 | .2877 | .2843 | .2810 | .2776 |
| 0.6 | .2743 | .2709 | .2676 | .2643 | .2611 | .2578 | .2546 | .2514 | .2483 | .2451 |
| 0.7 | .2420 | .2389 | .2358 | .2327 | .2297 | .2266 | .2236 | .2206 | .2177 | .2148 |
| 0.8 | .2119 | .2090 | .2061 | .2033 | .2005 | .1977 | .1949 | .1922 | .1894 | .1867 |
| 0.9 | .1841 | .1814 | .1788 | .1762 | .1736 | .1711 | .1685 | .1660 | .1635 | .1611 |
| 1.0 | .1587 | .1562 | .1539 | .1515 | .1492 | .1469 | .1446 | .1423 | .1401 | .1379 |
| 1.1 | .1357 | .1335 | .1314 | .1292 | .1271 | .1251 | .1230 | .1210 | .1190 | .1170 |
| 1.2 | .1151 | .1131 | .1112 | .1093 | .1075 | .1056 | .1038 | .1020 | .1003 | .0985 |
| 1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |
| 1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| 1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| 1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| 1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| 1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| 1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | .0250 | .0244 | .0239 | .0233 |
| 2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| 2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| 2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| 2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| 2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| 2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0054 | .0052 | .0051 | .0049 | .0048 |
| 2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| 2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |

# 10. Train

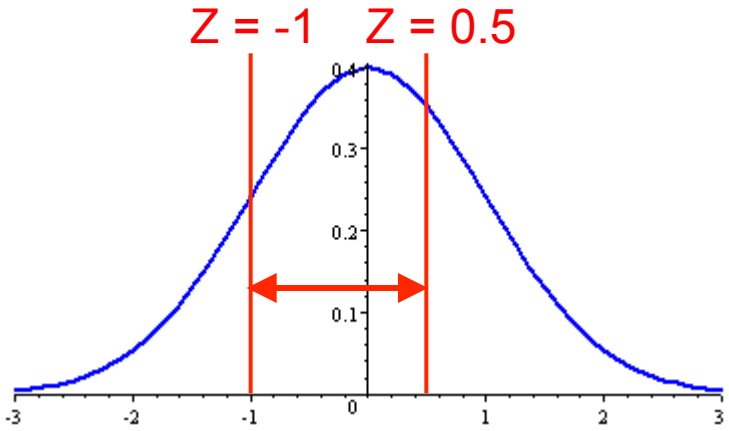
(b) $x \sim N(\mu = 120, \sigma = 10)$ $P(x > x_0) = p\left(Z \geq \frac{x_0 - \mu}{\sigma}\right)$

$$P(110 < x < 125) = P\left(\frac{110-120}{10} < Z < \frac{125-120}{10}\right)$$

$$= P(-1 < Z < +0.5)$$

# 10. Train

(b) $P(-1 < Z < +0.5)$



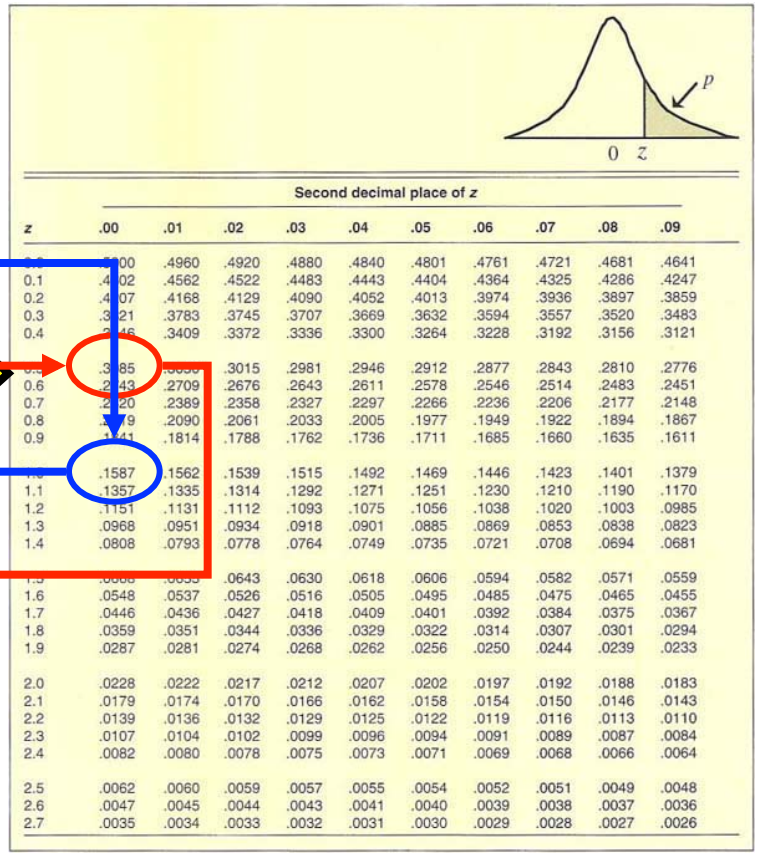

$= 1 - [P(Z<-1) + P(Z>0.5)]$

$P(Z < -1) = P(Z > 1)$

$= 1 - [P(Z>1) + P(Z>0.5)]$

$= 1 - 0.15866 - 0.30854$

$= 0.5328$






Second decimal place of $z$

| z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .5000 | .4960 | .4920 | .4880 | .4840 | .4801 | .4761 | .4721 | .4681 | .4641 |
| 0.1 | .4602 | .4562 | .4522 | .4483 | .4443 | .4404 | .4364 | .4325 | .4286 | .4247 |
| 0.2 | .4207 | .4168 | .4129 | .4090 | .4052 | .4013 | .3974 | .3936 | .3897 | .3859 |
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| 0.4 | .3446 | .3409 | .3372 | .3336 | .3300 | .3264 | .3228 | .3192 | .3156 | .3121 |
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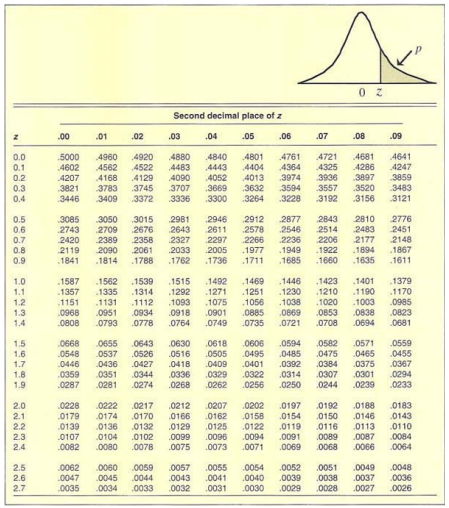
| 0.9 | .1841 | .1814 | .1788 | .1762 | .1736 | .1711 | .1685 | .1660 | .1635 | .1611 |
| 1.0 | .1587 | .1562 | .1539 | .1515 | .1492 | .1469 | .1446 | .1423 | .1401 | .1379 |
| 1.1 | .1357 | .1335 | .1314 | .1292 | .1271 | .1251 | .1230 | .1210 | .1190 | .1170 |
| 1.2 | .1151 | .1131 | .1112 | .1093 | .1075 | .1056 | .1038 | .1020 | .1003 | .0985 |
| 1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |
| 1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| 1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| 1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| 1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| 1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| 1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | .0250 | .0244 | .0239 | .0233 |
| 2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| 2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| 2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| 2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| 2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| 2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0054 | .0052 | .0051 | .0049 | .0048 |
| 2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| 2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |

# 10. Train

(c) $x \sim N(\mu = 120, \sigma = 10)$

$$P(x > x_0) = p\left(Z \geq \frac{x_0 - \mu}{\sigma}\right)$$



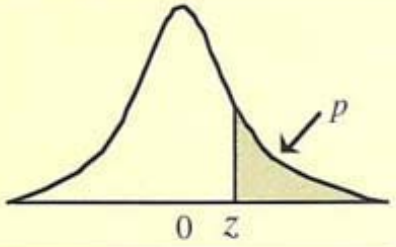
Second decimal place of $z$

| $z$ | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .5000 | .4960 | .4920 | .4880 | .4840 | .4801 | .4761 | .4721 | .4681 | .4641 |
| 0.1 | .4602 | .4562 | .4522 | .4483 | .4443 | .4404 | .4364 | .4325 | .4286 | .4247 |
| 0.2 | .4207 | .4168 | .4129 | .4090 | .4052 | .4013 | .3974 | .3936 | .3897 | .3859 |
| 0.3 | .3821 | .3783 | .3745 | .3707 | .3669 | .3632 | .3594 | .3557 | .3520 | .3483 |
| 0.4 | .3446 | .3409 | .3372 | .3336 | .3300 | .3264 | .3228 | .3192 | .3156 | .3121 |
| 0.5 | .3085 | .3050 | .3015 | .2981 | .2946 | .2912 | .2877 | .2843 | .2810 | .2776 |
| 0.6 | .2743 | .2709 | .2676 | .2643 | .2611 | .2578 | .2546 | .2514 | .2483 | .2451 |
| 0.7 | .2420 | .2389 | .2358 | .2327 | .2297 | .2266 | .2236 | .2206 | .2177 | .2148 |
| 0.8 | .2119 | .2090 | .2061 | .2033 | .2005 | .1977 | .1949 | .1922 | .1894 | .1867 |
| 0.9 | .1841 | .1814 | .1788 | .1762 | .1736 | .1711 | .1685 | .1660 | .1635 | .1611 |
| 1.0 | .1587 | .1562 | .1539 | .1515 | .1492 | .1469 | .1446 | .1423 | .1401 | .1379 |
| 1.1 | .1357 | .1335 | .1314 | .1292 | .1271 | .1251 | .1230 | .1210 | .1190 | .1170 |
| 1.2 | .1151 | .1131 | .1112 | .1093 | .1075 | .1056 | .1038 | .1020 | .1003 | .0985 |
| 1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |
| 1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| 1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| 1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| 1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| 1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| 1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | .0250 | .0244 | .0239 | .0233 |
| 2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| 2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| 2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| 2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| 2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| 2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0054 | .0052 | .0051 | .0049 | .0048 |
| 2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| 2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |

$$P(x > x_0) = p\left(Z \geq \frac{x_0 - 120}{10}\right)$$

$P(x > x_0) = 10\% = 0.10$

$$0.10 = p\left(Z \geq \frac{x_0 - 120}{10}\right)$$




| | Second decimal place of $z$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $z$ | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
| 0.0 | .5000 | .4960 | .4920 | .4880 | .4840 | .4801 | .4761 | .4721 | .4681 | .4641 |
| 0.1 | .4602 | .4562 | .4522 | .4483 | .4443 | .4404 | .4364 | .4325 | .4286 | .4247 |
| 0.2 | .4207 | .4168 | .4129 | .4090 | .4052 | .4013 | .3974 | .3936 | .3897 | .3859 |
| 0.3 | .3821 | .3783 | .3745 | .3707 | .3669 | .3632 | .3594 | .3557 | .3520 | .3483 |
| 0.4 | .3446 | .3409 | .3372 | .3336 | .3300 | .3264 | .3228 | .3192 | .3156 | .3121 |
| 0.5 | .3085 | .3050 | .3015 | .2981 | .2946 | .2912 | .2877 | .2843 | .2810 | .2776 |
| 0.6 | .2743 | .2709 | .2676 | .2643 | .2611 | .2578 | .2546 | .2514 | .2483 | .2451 |
| 0.7 | .2420 | .2389 | .2358 | .2327 | .2297 | .2266 | .2236 | .2206 | .2177 | .2148 |
| 0.8 | .2119 | .2090 | .2061 | .2033 | .2005 | .1977 | .1949 | .1922 | .1894 | .1867 |
| 0.9 | .1841 | .1814 | .1788 | .1762 | .1736 | .1711 | .1685 | .1660 | .1635 | .1611 |
| 1.0 | .1587 | .1562 | .1539 | .1515 | .1492 | .1469 | .1446 | .1423 | .1401 | .1379 |
| 1.1 | .1357 | .1335 | .1314 | .1292 | .1271 | .1251 | .1230 | .1210 | .1190 | .1170 |
| 1.2 | .1151 | .1131 | .1112 | .1093 | .1075 | .1056 | .1038 | .1020 | .1003 | .0985 |
| 1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |
| 1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| 1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| 1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| 1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| 1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| 1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | .0250 | .0244 | .0239 | .0233 |
| 2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| 2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| 2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| 2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| 2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| 2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0054 | .0052 | .0051 | .0049 | .0048 |
| 2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| 2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |

$$0.10 = p\left(Z \geq \frac{x_0 - 120}{10}\right)$$

$$1.2816 = \left(\frac{x_0 - 120}{10}\right)$$

$$X_0 = 132.816$$

minutes

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