

After this lecture you will have what
you need to do all problems in HW2

It is now due a week from now
March 7, 2024

Matlab exercise:

- Generate a sample of 100,000 variables with “Harry Potter” Gamma distribution with $r = 0.1$ and $k = 9 \frac{3}{4}$ (9.75)
- Calculate mean and compare it to k/r (Gamma)
- Calculate standard deviation and compare it to \sqrt{k}/r (Gamma)
- Plot semilog-y plots of **PDFs** and **CCDFs**.
- **Hint:** read the help page (better yet documentation webpage) for `random('Gamma'...)`: one of **their parameters is different than r**

Matlab exercise: Gamma

- `Stats=100000; r=0.1; k=9.75;`
- `r2=random('Gamma', k,1./r, Stats,1);`
- `disp([mean(r2),k./r]);`
- `disp([std(r2),sqrt(k)./r]);`
- `step=0.1; [a,b]=hist(r2,0:step:max(r2));`
- `pdf_g=a./sum(a)./step;`
- `figure;`
- `subplot(1,2,1); semilogy(b,pdf_g,'ko-'); hold on;`
- `x=0:0.01:max(r2); clear cdf_g;`
- `for m=1:length(x);`
- `cdf_g(m)=sum(r2>x(m))./Stats;`
- `end;`
- `subplot(1,2,2); semilogy(x,cdf_g,'rd-');`

Continuous Probability Distributions

Normal or Gaussian Distribution



**PAY
ATTENTION**

Normal or Gaussian Distribution

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

$$-\infty < x < \infty$$

is a **normal random variable**

with mean μ ,

and standard deviation σ

sometimes denoted as

$$N(\mu, \sigma)$$



Carl Friedrich Gauss (1777 –1855)
German mathematician

Normal Distribution

- The location and spread of the normal are independently determined by mean (μ) and standard deviation (σ)

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

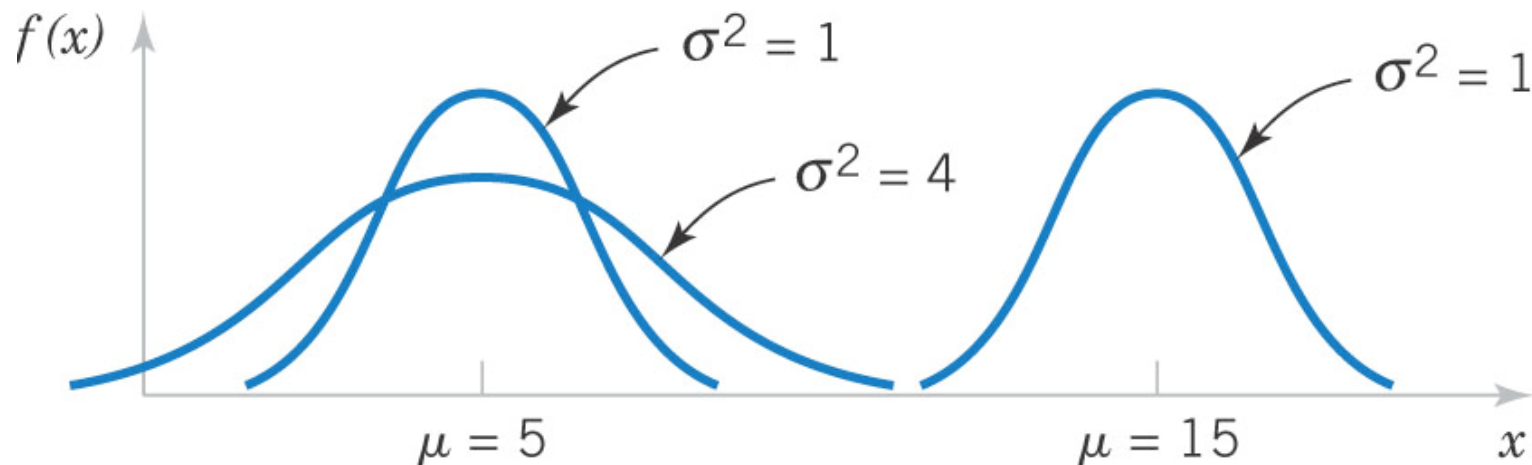


Figure 4-10 Normal probability density functions

Matlab exercise:
plot PDF of the Gaussian distribution
with mu=3; sigma=2

calculate mean, standard deviation
and variance,

Linear-y and Semilog-y plots of PDF

Hint:

Generate Standard normal
distribution using

randn(Stats,1) then

multiply and add using sigma, mu

Matlab exercise solution

- **Stats=100000;**
- **mu=3; sigma=2;**
- **r1=sigma.*randn(Stats,1)+mu;**
- **step=0.1;**
- **[a,b]=hist(r1,(mu-10.*sigma):step:(mu+10.*sigma));**
- **pdf_n=a./sum(a)./step;**
- **figure; subplot(1,2,1); plot(b,pdf_n,'ko-');**
- **subplot(1,2,2); semilogy(b,pdf_n,'ko-');**

Gaussian (Normal) distribution is very important because **any sum of many independent random variables** can be **approximated with a Gaussian**

Standard Normal Distribution

- A normal (Gaussian) random variable with

$$\mu = 0 \text{ and } \sigma^2 = 1$$

is called a **standard normal random variable** and is denoted as Z .

- The cumulative distribution function of a **standard normal random variable** is denoted as:

$$\Phi(z) = P(Z \leq z)$$

- Values are found in **Appendix A Table III** to **Montgomery and Runger textbook**

Standardizing

If X is a normal random variable with $E(X) = \mu$ and $V(X) = \sigma^2$, the random variable

$$Z = \frac{X - \mu}{\sigma} \quad (4-10)$$

is a normal random variable with $E(Z) = 0$ and $V(Z) = 1$. That is, Z is a standard normal random variable.

Suppose X is a normal random variable with mean μ and variance σ^2 .

$$\text{Then, } P(X \leq x) = P\left(\frac{X - \mu}{\sigma} \leq \frac{x - \mu}{\sigma}\right) = P(Z \leq z) \quad (4-11)$$

where Z is a **standard normal random variable**, and

$z = \frac{(x - \mu)}{\sigma}$ is the z-value obtained by **standardizing** x .

The probability is obtained by using Appendix Table III

$$P(X < \mu - \sigma) = P(X > \mu + \sigma) = (1 - 0.68) / 2 = 0.16 = 16\%$$

$$P(X < \mu - 2\sigma) = P(X > \mu + 2\sigma) = (1 - 0.95) / 2 = 0.023 = 2.3\%$$

$$P(X < \mu - 3\sigma) = P(X > \mu + 3\sigma) = (1 - 0.997) / 2 = 0.0013 = 0.13\%$$

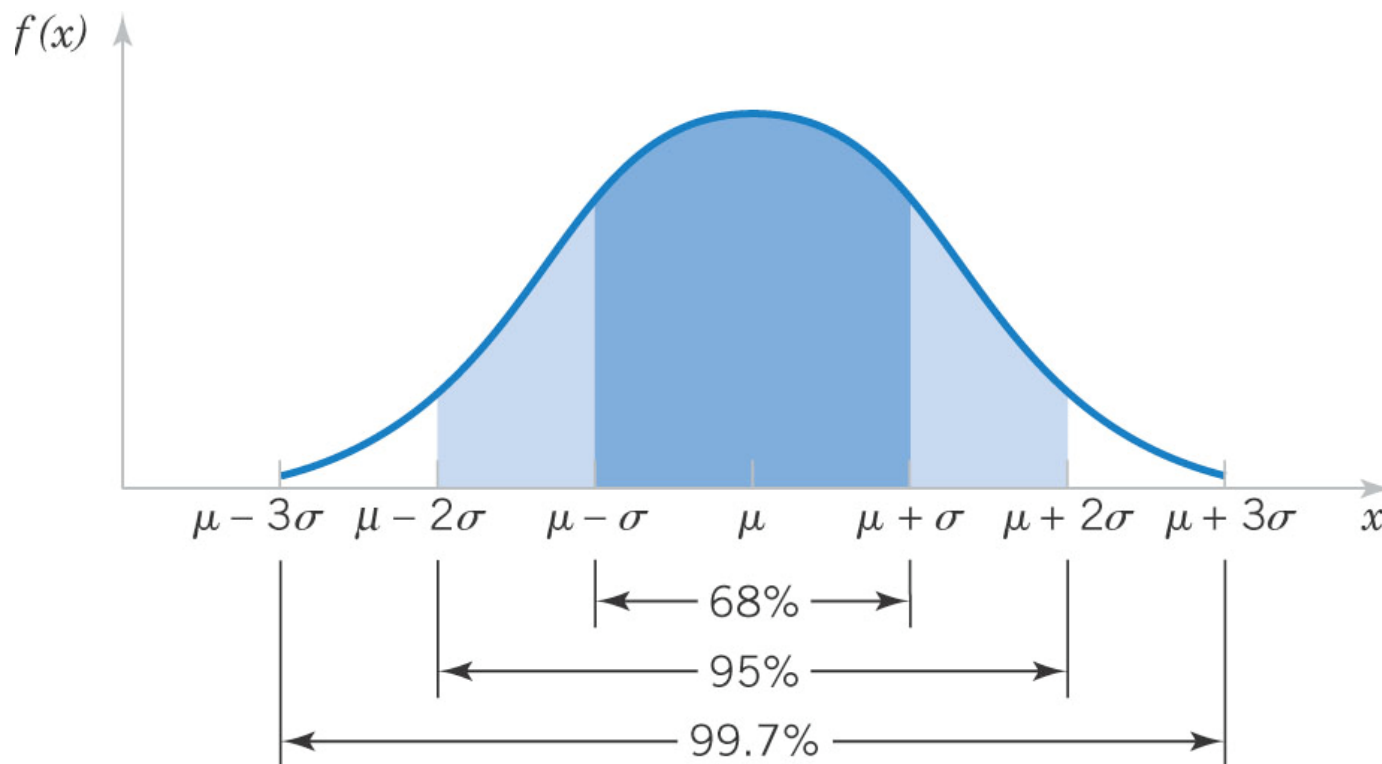


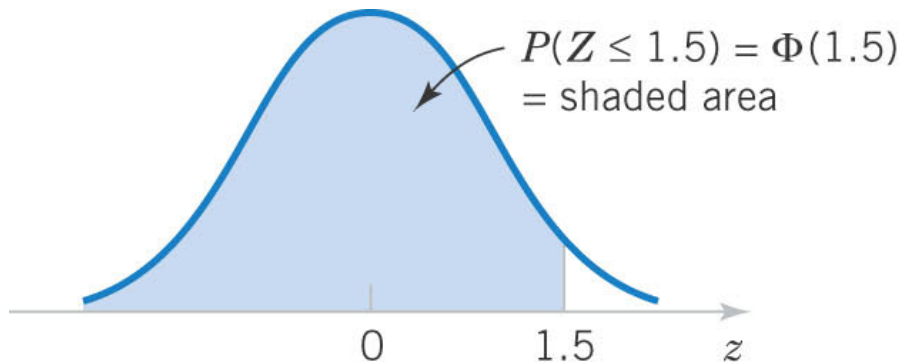
Figure 4-12 Probabilities associated with a normal distribution – well worth remembering to quickly estimate probabilities.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.500000	0.503989	0.507978	0.511967	0.515953	0.519939	0.523922	0.527903	0.531881	0.535856
0.1	0.539828	0.543795	0.547758	0.551717	0.555670	0.559618	0.563559	0.567495	0.571424	0.575345
0.2	0.579260	0.583166	0.587064	0.590954	0.594835	0.598706	0.602568	0.606420	0.610261	0.614092
0.3	0.617911	0.621719	0.625516	0.629300	0.633072	0.636831	0.640576	0.644309	0.648027	0.651732
0.4	0.655422	0.659097	0.662757	0.666402	0.670031	0.673645	0.677242	0.680822	0.684386	0.687933
0.5	0.691462	0.694974	0.698468	0.701944	0.705401	0.708840	0.712260	0.715661	0.719043	0.722405
0.6	0.725747	0.729069	0.732371	0.735653	0.738914	0.742154	0.745373	0.748571	0.751748	0.754903
0.7	0.758036	0.761148	0.764238	0.767305	0.770350	0.773373	0.776373	0.779350	0.782305	0.785236
0.8	0.788145	0.791030	0.793892	0.796731	0.799546	0.802338	0.805106	0.807850	0.810570	0.813267
0.9	0.815940	0.818589	0.821214	0.823815	0.826391	0.828944	0.831472	0.833977	0.836457	0.838913
1.0	0.841345	0.843752	0.846136	0.848495	0.850830	0.853141	0.855428	0.857690	0.859929	0.862143
1.1	0.864334	0.866500	0.868643	0.870762	0.872857	0.874928	0.876976	0.878999	0.881000	0.882977
1.2	0.884930	0.886860	0.888767	0.890651	0.892512	0.894350	0.896165	0.897958	0.899727	0.901475
1.3	0.903199	0.904902	0.906582	0.908241	0.909877	0.911492	0.913085	0.914657	0.916207	0.917736
1.4	0.919243	0.920730	0.922196	0.923641	0.925066	0.926471	0.927855	0.929219	0.930563	0.931888
1.5	0.933193	0.934478	0.935744	0.936992	0.938220	0.939429	0.940620	0.941792	0.942947	0.944083
1.6	0.945201	0.946301	0.947384	0.948449	0.949497	0.950529	0.951543	0.952540	0.953521	0.954486
1.7	0.955435	0.956367	0.957284	0.958185	0.959071	0.959941	0.960796	0.961636	0.962462	0.963273
1.8	0.964070	0.964852	0.965621	0.966375	0.967116	0.967843	0.968557	0.969258	0.969946	0.970621
1.9	0.971283	0.971933	0.972571	0.973197	0.973810	0.974412	0.975002	0.975581	0.976148	0.976705
2.0	0.977250	0.977784	0.978308	0.978822	0.979325	0.979818	0.980301	0.980774	0.981237	0.981691
2.1	0.982136	0.982571	0.982997	0.983414	0.983823	0.984222	0.984614	0.984997	0.985371	0.985738
2.2	0.986097	0.986447	0.986791	0.987126	0.987455	0.987776	0.988089	0.988396	0.988696	0.988989
2.3	0.989276	0.989556	0.989830	0.990097	0.990358	0.990613	0.990863	0.991106	0.991344	0.991576
2.4	0.991802	0.992024	0.992240	0.992451	0.992656	0.992857	0.993053	0.993244	0.993431	0.993613
2.5	0.993790	0.993963	0.994132	0.994297	0.994457	0.994614	0.994766	0.994915	0.995060	0.995201
2.6	0.995339	0.995473	0.995604	0.995731	0.995855	0.995975	0.996093	0.996207	0.996319	0.996427
2.7	0.996533	0.996636	0.996736	0.996833	0.996928	0.997020	0.997110	0.997197	0.997282	0.997365
2.8	0.997445	0.997523	0.997599	0.997673	0.997744	0.997814	0.997882	0.997948	0.998012	0.998074
2.9	0.998134	0.998193	0.998250	0.998305	0.998359	0.998411	0.998462	0.998511	0.998559	0.998605
3.0	0.998650	0.998694	0.998736	0.998777	0.998817	0.998856	0.998893	0.998930	0.998965	0.998999
3.1	0.999032	0.999065	0.999096	0.999126	0.999155	0.999184	0.999211	0.999238	0.999264	0.999289
3.2	0.999313	0.999336	0.999359	0.999381	0.999402	0.999423	0.999443	0.999462	0.999481	0.999499
3.3	0.999517	0.999533	0.999550	0.999566	0.999581	0.999596	0.999610	0.999624	0.999638	0.999650
3.4	0.999663	0.999675	0.999687	0.999698	0.999709	0.999720	0.999730	0.999740	0.999749	0.999758
3.5	0.999767	0.999776	0.999784	0.999792	0.999800	0.999807	0.999815	0.999821	0.999828	0.999835
3.6	0.999841	0.999847	0.999853	0.999858	0.999864	0.999869	0.999874	0.999879	0.999883	0.999888
3.7	0.999892	0.999896	0.999900	0.999904	0.999908	0.999912	0.999915	0.999918	0.999922	0.999925
3.8	0.999928	0.999931	0.999933	0.999936	0.999938	0.999941	0.999943	0.999946	0.999948	0.999950
3.9	0.999952	0.999954	0.999956	0.999958	0.999959	0.999961	0.999963	0.999964	0.999966	0.999967

Standard Normal Distribution Tables

Assume Z is a standard normal random variable.

Find $P(Z \leq 1.50)$. Answer: 0.93319



z	0.00	0.01	0.02	0.03
0	0.50000	0.50399	0.50398	0.51197
\vdots		\vdots		
1.5	0.93319	0.93448	0.93574	0.93699

Figure 4-13 Standard normal PDF

Table III from,
Appendix A in
Montgomery
& Runger

Find $P(Z \leq 1.53)$.

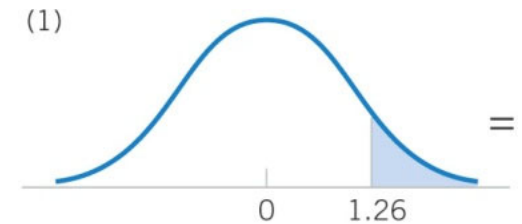
Answer: 0.93699

Find $P(Z \leq 0.02)$.

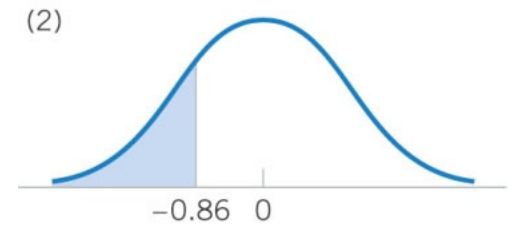
Answer: 0.50398

Standard Normal Exercises

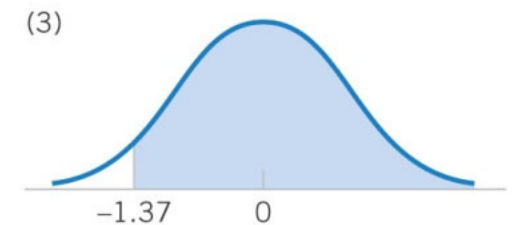
1. $P(Z > 1.26) = 1 - P(Z < 1.26) = 1 - 0.8962 =$
 $= \underline{0.1038}$



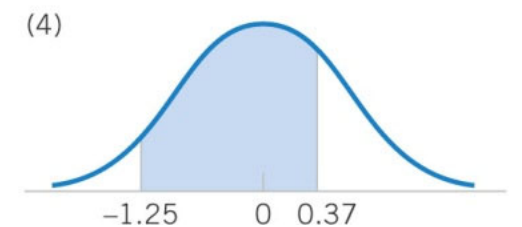
2. $P(Z < -0.86) = P(Z > 0.86) = 1 - P(Z < 0.86) =$
 $1 - 0.815 = \underline{0.195}$



3. $P(Z > -1.37) = P(Z < 1.37) = \underline{0.915}$



4. $P(-1.25 < Z < 0.37) = P(Z < 0.37) - P(Z < -1.25)$
 $= P(Z < 0.37) - P(Z > 1.25) = P(Z < 0.37) -$
 $(1 - P(Z < 1.25)) = 0.6443 - (1 - 0.8944) = \underline{0.5387}$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.500000	0.503989	0.507978	0.511967	0.515953	0.519939	0.523922	0.527903	0.531881	0.535856
0.1	0.539828	0.543795	0.547758	0.551717	0.555670	0.559618	0.563559	0.567495	0.571424	0.575345
0.2	0.579260	0.583166	0.587064	0.590954	0.594835	0.598706	0.602568	0.606420	0.610261	0.614092
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1.9	0.971283	0.971933	0.972571	0.973197	0.973810	0.974412	0.975002	0.975581	0.976148	0.976705
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2.1	0.982136	0.982571	0.982997	0.983414	0.983823	0.984222	0.984614	0.984997	0.985371	0.985738
2.2	0.986097	0.986447	0.986791	0.987126	0.987455	0.987776	0.988089	0.988396	0.988696	0.988989
2.3	0.989276	0.989556	0.989830	0.990097	0.990358	0.990613	0.990863	0.991106	0.991344	0.991576
2.4	0.991802	0.992024	0.992240	0.992451	0.992656	0.992857	0.993053	0.993244	0.993431	0.993613
2.5	0.993790	0.993963	0.994132	0.994297	0.994457	0.994614	0.994766	0.994915	0.995060	0.995201
2.6	0.995339	0.995473	0.995604	0.995731	0.995855	0.995975	0.996093	0.996207	0.996319	0.996427
2.7	0.996533	0.996636	0.996736	0.996833	0.996928	0.997020	0.997110	0.997197	0.997282	0.997365
2.8	0.997445	0.997523	0.997599	0.997673	0.997744	0.997814	0.997882	0.997948	0.998012	0.998074
2.9	0.998134	0.998193	0.998250	0.998305	0.998359	0.998411	0.998462	0.998511	0.998559	0.998605
3.0	0.998650	0.998694	0.998736	0.998777	0.998817	0.998856	0.998893	0.998930	0.998965	0.998999
3.1	0.999032	0.999065	0.999096	0.999126	0.999155	0.999184	0.999211	0.999238	0.999264	0.999289
3.2	0.999313	0.999336	0.999359	0.999381	0.999402	0.999423	0.999443	0.999462	0.999481	0.999499
3.3	0.999517	0.999533	0.999550	0.999566	0.999581	0.999596	0.999610	0.999624	0.999638	0.999650
3.4	0.999663	0.999675	0.999687	0.999698	0.999709	0.999720	0.999730	0.999740	0.999749	0.999758
3.5	0.999767	0.999776	0.999784	0.999792	0.999800	0.999807	0.999815	0.999821	0.999828	0.999835
3.6	0.999841	0.999847	0.999853	0.999858	0.999864	0.999869	0.999874	0.999879	0.999883	0.999888
3.7	0.999892	0.999896	0.999900	0.999904	0.999908	0.999912	0.999915	0.999918	0.999922	0.999925
3.8	0.999928	0.999931	0.999933	0.999936	0.999938	0.999941	0.999943	0.999946	0.999948	0.999950
3.9	0.999952	0.999954	0.999956	0.999958	0.999959	0.999961	0.999963	0.999964	0.999966	0.999967

Credit: XKCD
comics

WHY ARE THERE SLAVES IN THE BIBLE

WHY DO TWINS HAVE DIFFERENT FINGERPRINTS
WHY ARE AMERICANS AFRAID OF DRAGONS

WHY IS HTTPS CROSSED OUT IN RED
WHY IS THERE A LINE THROUGH HTTPS
WHY IS THERE A RED LINE THROUGH HTTPS ON FACEBOOK
WHY IS HTTPS IMPORTANT

QUESTIONS

FOUND IN GOOGLE AUTOCOMPLETE



WHY ARE THERE WEEKS
WHY DO I FEEL DIZZY

WHY AREN'T ECONOMISTS RICH

WHY ARE THERE SO MANY CROWS IN ROCHESTER, MN

WHY DO AMERICANS CALL IT SOCCER

WHY IS PSYCHIC WEAK TO BUG

WHY ARE MY EARS RINGING

WHY DO CHILDREN GET CANCER

WHY ARE THERE SO MANY AVENGERS

WHY IS POSEIDON ANGRY WITH ODYSSEUS

WHY ARE THE AVENGERS FIGHTING THE X MEN

WHY IS THERE ICE IN SPACE

WHY ARE THERE ANTS IN MY LAPTOP

WHY IS EARTH TILTED

WHY ARE THERE GHOSTS

WHY IS THERE AN OWL IN MY BACKYARD

WHY IS SPACE BLACK

WHY ARE THERE GHOSTS

WHY IS THERE AN OWL OUTSIDE MY WINDOW

WHY IS OUTER SPACE SO COLD

WHY ARE THERE GHOSTS

WHY IS THERE AN OWL ON THE DOLLAR BILL

WHY ARE THERE PYRAMIDS ON THE MOON

WHY ARE THERE GHOSTS

WHY DO OWLS ATTACK PEOPLE

WHY IS NASA SHUTTING DOWN

WHY ARE THERE GHOSTS

WHY ARE AK 47s SO EXPENSIVE

WHY ARE THERE MALE AND FEMALE BIKES

WHY ARE THERE GHOSTS

WHY ARE THERE HELICOPTERS CIRCLING MY HOUSE

WHY ARE THERE TINY SPIDERS IN MY HOUSE

WHY ARE THERE GHOSTS

WHY ARE THERE GODS

WHY DO SPIDERS COME INSIDE

WHY ARE THERE GHOSTS

WHY ARE THERE TWO SPOCKS

WHY ARE THERE HUGE SPIDERS IN MY HOUSE

WHY ARE THERE GHOSTS

WHY IS LIFE SO BORING

WHY ARE THERE LOTS OF SPIDERS IN MY HOUSE

WHY ARE THERE GHOSTS

WHY ARE CIGARETTES LEGAL

WHY ARE THERE SPIDERS IN MY ROOM

WHY ARE THERE GHOSTS

WHY ARE THERE DUCKS IN MY POOL

WHY ARE THERE SO MANY SPIDERS IN MY ROOM

WHY ARE THERE GHOSTS

WHY IS JESUS WHITE

WHY DO SPIDER BITES ITCH

WHY ARE THERE GHOSTS

WHY IS THERE LIQUID IN MY EAR

WHY IS DYING SO SCARY

WHY ARE THERE GHOSTS

WHY DO Q TIPS FEEL GOOD

WHY DO WHALES JUMP
WHY ARE WITCHES GREEN
WHY ARE THERE MIRRORS ABOVE BEDS

WHY DO I SAY UH
WHY IS SEA SALT BETTER
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WHY ARE THERE BRIDESMAIDS

WHY DO DYING PEOPLE REACH UP
WHY AREN'T THERE VARICOSE ARTERIES
WHY ARE OLD KUNGONS DIFFERENT

WHY IS PROGRAMMING SO HARD
WHY IS THERE A 0 OHM RESISTOR
WHY DO AMERICANS HATE SOCCER

WHY DO RHYMES SOUND GOOD
WHY DO TREES DIE
WHY IS THERE NO SOUND ON CNN

WHY DO IGUANAS DIE

DINOSAUR GHOSTS

WHY ARE THERE FEMALE MR NIMES

WHY IS LIFE SO BORING

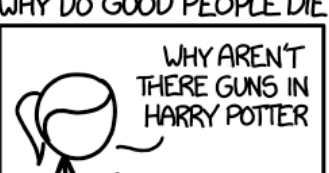
WHY ARE DOGS AFRAID OF FIREWORKS



WHY IS THERE HELL IF GOD FORGIVES



WHY IS GPS FREE



WHY ARE ULTRASOUNDS IMPORTANT
WHY ARE ULTRASOUND MACHINES EXPENSIVE
WHY IS STEALING WRONG

Range	The expected fraction of population inside the range	Approximate expected frequency outside the range	The approximate frequency for daily event
$\mu \pm 0.5\sigma$	0.382924922548026		2 in 3 Four or five times a week
$\mu \pm 1\sigma$	0.682689492137086		1 in 3 Twice a week
$\mu \pm 1.5\sigma$	0.866385597462284		1 in 7 Weekly
$\mu \pm 2\sigma$	0.954499736103642		1 in 22 Every three weeks
$\mu \pm 2.5\sigma$	0.987580669348448		1 in 81 Quarterly
$\mu \pm 3\sigma$	0.997300203936740		1 in 370 Yearly
$\mu \pm 3.5\sigma$	0.999534741841929		1 in 2149 Every six years
$\mu \pm 4\sigma$	0.999936657516334		1 in 15787 Every 43 years (twice in a lifetime)
$\mu \pm 4.5\sigma$	0.999993204653751		1 in 147160 Every 403 years (once in the modern era)
$\mu \pm 5\sigma$	0.999999426696856		1 in 1744278 Every 4776 years (once in recorded history)
$\mu \pm 5.5\sigma$	0.999999962020875		1 in 26330254 Every 72090 years (thrice in history of modern humankind)
$\mu \pm 6\sigma$	0.999999998026825		1 in 506797346 Every 1.38 million years (twice in history of humankind)
$\mu \pm 6.5\sigma$	0.999999999919680		1 in 12450197393 Every 34 million years (twice since the extinction of dinosaurs)
$\mu \pm 7\sigma$	0.999999999997440		1 in 390682215445 Every 1.07 billion years (four times in history of Earth)

Source: Wikipedia

DATA SCIENCE
DISCOVERY

Human Impact of Probabilities
STAT 107: Data Science Discovery

Business buzzword: Six Sigma



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Six Sigma

From Wikipedia, the free encyclopedia

For other uses, see [Sigma 6](#).

Six Sigma is a set of techniques and tools for process improvement. It was introduced by engineer Bill Smith while working at [Motorola](#) in 1986.^{[1][2]} [Jack Welch](#) made it central to his business strategy at [General Electric](#) in 1995.^[3] Today, it is used in many industrial sectors.^[4]

Business literature defined **six sigma**
as no more than **3.4 defective products**
per million

Matlab group exercise 3

- $P(X-\mu > z \cdot \sigma) = P(Z > z) = (1 - \text{erf}(z./\text{sqrt}(2)))/2$
- You can also use `1-normcdf(z)`
- Calculate $\text{Prob}(X-\mu > 6\sigma)$ and compare with expected 3.4 errors per million
- Find z such that $\text{Prob}(X-\mu > z \cdot \sigma) = 3.4$ errors per million

What Six Sigma should be really called
if $P(X-\mu > z \cdot \sigma) = 3.4e-6$

- A. 6 sigma
- B. 7 sigma
- C. 3 sigma
- D. 4.5 sigma
- E. I could not figure it out

Get your i-clickers

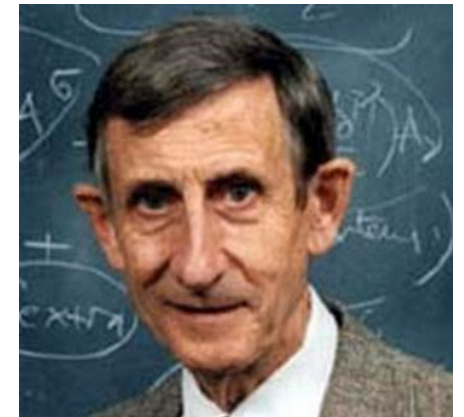
Appendix Table III is no good for 6-sigma How to calculate in Matlab?

- Matlab has a built-in function `normcdf`
- $1-\text{normcdf}(z)$ is the $\text{Prob}[X-\mu > z \cdot \sigma]$
- I expected: $P(Z > 6) = 3.4e-6$
- Matlab says $1-\text{normcdf}(6) \sim 1e-9$
- Six sigma is not 6σ at all !!!
- Let's find out how many sigmas are in six sigma
- Matlab says: $\text{invnorm}(3.4e-6) = 4.5$
- Six sigma should be called 4.5σ
- Does not have the same buzz

What's wrong with Six Sigma?

- Motorola has determined, through years of process and data collection, that processes vary and drift over time – what they call the Long-Term Dynamic Mean Variation. This variation typically falls **between 1.4 and 1.6**. They shifted their sigma down by **1.5**.
- The statistician [Donald J. Wheeler](#) has dismissed the **1.5 sigma shift** as "goofy" because of its arbitrary nature.
- A [Fortune](#) article stated that "of **58 large companies** that have announced Six Sigma programs, **91 percent have trailed (performed below)** the S&P 500 index since"

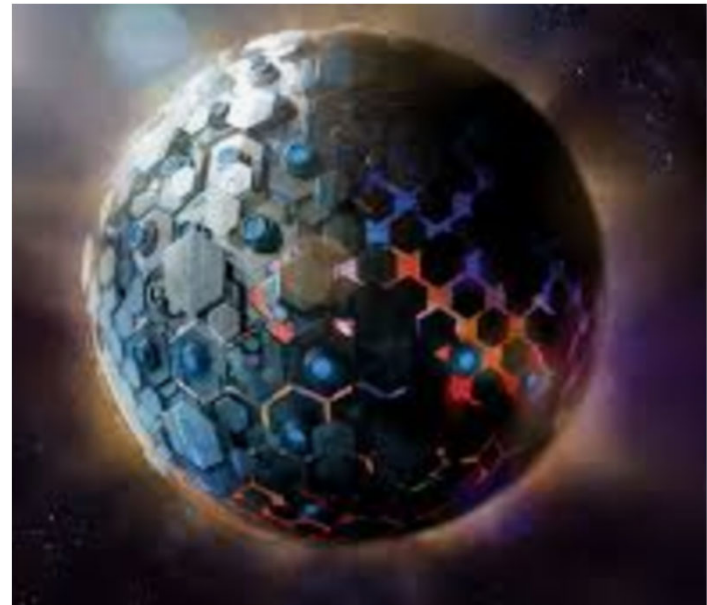
- **Freeman Dyson** (a famous theoretical physicist) once sat on a committee reviewing Department of Energy Joint Genomics Institute (DOE JGI)
- Motorola sent their **six-sigma preacher** Freeman Dyson asked him:
 - **D: Can you explain me what is six-sigma?**
 - P: Mumbling something about it being the gold standard of reliability
 - **D: Can you at least define one-sigma?**
 - P: Silence
- Six-sigma was never implemented at JGI



Born:
December 15, 1923,
Crowthorne, UK
Died:
February 28, 2020
Princeton, NJ USA

Dyson's legacy

- **Seminal contributions to quantum mechanics**
- The Origin of Life:
Cells → Enzymes → DNA/RNA later
First proposed by Alexander Oparin in 1922
- Dyson sphere:
Completely
captures light from a star
- Dyson tree:
genetically engineered
tree growing inside a
comet



Credit: XKCD
comics

WHY ARE THERE SLAVES IN THE BIBLE

WHY DO TWINS HAVE DIFFERENT FINGERPRINTS
WHY ARE AMERICANS AFRAID OF DRAGONS

WHY IS HTTPS CROSSED OUT IN RED
WHY IS THERE A LINE THROUGH HTTPS
WHY IS THERE A RED LINE THROUGH HTTPS ON FACEBOOK
WHY IS HTTPS IMPORTANT

QUESTIONS FOUND IN GOOGLE AUTOCOMplete



WHY ARE THERE WEEKS
WHY DO I FEEL DIZZY

WHY AREN'T ECONOMISTS RICH
WHY DO AMERICANS CALL IT SOCCER
WHY ARE MY EARS RINGING
WHY ARE THERE SO MANY AVENGERS
WHY ARE THE AVENGERS FIGHTING THE X MEN
WHY IS WOLVERINE NOT IN THE AVENGERS

WHY ARE THERE SWARMS OF GNATS
WHY IS THERE PHLEGM
WHY ARE THERE SO MANY CROWS IN ROCHESTER, MN
WHY IS PSYCHIC WEAK TO BUG
WHY DO CHILDREN GET CANCER
WHY IS POSEIDON ANGRY WITH ODYSSEUS
WHY IS THERE ICE IN SPACE

WHY ARE THERE ANTS IN MY LAPTOP

WHY IS EARTH TILTED
WHY IS SPACE BLACK
WHY IS OUTER SPACE SO COLD
WHY ARE THERE PYRAMIDS ON THE MOON
WHY IS NASA SHUTTING DOWN



WHY IS THERE AN OWL IN MY BACKYARD
WHY IS THERE AN OWL OUTSIDE MY WINDOW
WHY IS THERE AN OWL ON THE DOLLAR BILL
WHY DO OWLS ATTACK PEOPLE
WHY ARE AK 47s SO EXPENSIVE
WHY ARE THERE HELICOPTERS CIRCLING MY HOUSE
WHY ARE THERE GODS
WHY ARE THERE TWO SPOCKS

WHY ARE DOGS AFRAID OF FIREWORKS
WHY IS THERE NO KING IN ENGLAND

WHY DO WHALES JUMP
WHY ARE WITCHES GREEN
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WHY IS OHIO WEATHER SO WEIRD

WHY ARE THERE MALE AND FEMALE BIKES
WHY ARE THERE TINY SPIDERS IN MY HOUSE
WHY DO SPIDERS COME INSIDE
WHY ARE THERE HUGE SPIDERS IN MY HOUSE
WHY ARE THERE LOTS OF SPIDERS IN MY HOUSE
WHY ARE THERE SPIDERS IN MY ROOM
WHY ARE THERE SO MANY SPIDERS IN MY ROOM
WHY DO SPIDER BITES ITCH
WHY IS DYING SO SCARY



WHY ARE THERE BRIDESMAIDS
WHY DO DYING PEOPLE REACH UP
WHY AREN'T THERE VARICOSE ARTERIES
WHY ARE OLD KUNGONS DIFFERENT
WHY IS THERE HELL IF GOD FORGIVES
WHY IS THERE NO GPS IN LAPTOPS
WHY DO KNEES CLICK
WHY AREN'T THERE E GRADES
WHY IS ISOLATION BAD
WHY DO BOYS LIKE ME
WHY DON'T BOYS LIKE ME
WHY IS THERE ALWAYS A JAVA UPDATE
WHY ARE THERE RED DOTS ON MY THIGHS
WHY IS LYING GOOD



WHY IS MT VESUVIUS THERE
WHY DO THEY SAY T MINUS
WHY ARE THERE OBELISKS
WHY ARE WRESTLERS ALWAYS WET
WHY ARE OCEANS BECOMING MORE ACIDIC
WHY IS ARWEN DYING
WHY AREN'T MY QUAIL LAYING EGGS
WHY AREN'T MY QUAIL EGGS HATCHING
WHY AREN'T THERE ANY FOREIGN MILITARY BASES IN AMERICA

WHY ARE CIGARETTES LEGAL
WHY ARE THERE DUCKS IN MY POOL
WHY IS JESUS WHITE
WHY IS THERE LIQUID IN MY EAR
WHY DO Q TIPS FEEL GOOD
WHY DO GOOD PEOPLE DIE



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