IMM - DTU

02405 Probability
2005-10-29
BFN/bfn

We use the knowledge of the half-life to find λ from

We use the knowledge of the half-life to find λ from example 2 page 282, λ

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$
Question a) The probability that an atom survives at least 5 years is given by

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279.

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5)$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t,

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question.

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$,

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms.

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary,

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t)$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$.

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 (

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^{\star}$), we get

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 $(t^\star)$, we get

$$1024$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star \ln(2)}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star \ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

Question d) This question can be formulated as

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

Question d) This question can be formulated as $P(N_{t^\star} = 0)$.

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

Question d) This question can be formulated as $P(N_{t^\star} = 0)$. From the binomial distribution of $N_{t^\star}$ we get

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

Question d) This question can be formulated as $P(N_{t^\star} = 0)$. From the binomial distribution of $N_{t^\star}$ we get

$$\left(\frac{1023}{1024}\right)^{1024}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln{(2)}}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln{(2)}} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln{(2)}}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln{(2)}}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln{(2)}} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln{(0.1)}}{\ln{(2)}}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln{(2)}} = 1 \Rightarrow t^\star = \frac{\ln{(1024)}}{\ln{(2)}} = 10$$

Question d) This question can be formulated as $P(N_{t^\star} = 0)$. From the binomial distribution of $N_{t^\star}$ we get

$$\left(\frac{1023}{1024}\right)^{1024} = 0.3677$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

Question d) This question can be formulated as $P(N_{t^\star} = 0)$. From the binomial distribution of $N_{t^\star}$ we get

$$\left(\frac{1023}{1024}\right)^{1024} = 0.3677$$

or

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

Question d) This question can be formulated as $P(N_{t^\star} = 0)$. From the binomial distribution of $N_{t^\star}$ we get

$$\left(\frac{1023}{1024}\right)^{1024} = 0.3677$$

or

$$\left(\frac{1023}{1024}\right)^{1024}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

Question d) This question can be formulated as $P(N_{t^\star} = 0)$. From the binomial distribution of $N_{t^\star}$ we get

$$\left(\frac{1023}{1024}\right)^{1024} = 0.3677$$

or

$$\left(\frac{1023}{1024}\right)^{1024} = \left(1 - \frac{1}{1024}\right)^{1024}$$

We use the knowledge of the half-life to find λ from example 2 page 282, $\lambda = \frac{\ln(2)}{1}$

Question a) The probability that an atom survives at least 5 years is given by the survival function page 279. We get with T denoting the life time of an atom

$$P(T > 5) = e^{-5\ln(2)} = \frac{1}{32}$$

Question b) If we let N_t denote the number of atoms surviving at time t, then the distribution of this random variable will be binomial with the probability found in the previous question. Thus $N_t \in bin\left(n, e^{-t\ln(2)}\right)$, where $n = N_0$ is the original number of atoms. The expected value $E(N_t)$ of this binomial distribution is given page 476 or 479 in the distribution summary, such that $E(N_t) = ne^{-t\ln(2)}$. We find $t_{10\%}$ as , using the method on page 282 once more,

$$ne^{-t\ln(2)} = \frac{n}{10} \Rightarrow t_{10\%} = \frac{-\ln(0.1)}{\ln(2)}.$$

Question c) Applying the same method to find the time where the expected number of atoms remaining of 1024 is 10 ($t^\star$), we get

$$1024e^{-t^\star\ln(2)} = 1 \Rightarrow t^\star = \frac{\ln(1024)}{\ln(2)} = 10$$

Question d) This question can be formulated as $P(N_{t^\star} = 0)$. From the binomial distribution of $N_{t^\star}$ we get

$$\left(\frac{1023}{1024}\right)^{1024} = 0.3677$$

or

$$\left(\frac{1023}{1024}\right)^{1024} = \left(1 - \frac{1}{1024}\right)^{1024} \tilde{=} e^{-1}$$