



ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ

Σχολή Ηλεκτρολόγων Μηχανικών & Μηχανικών Υπολογιστών

Εργαστήριο Διοίκησης Πληροφοριακών Συστημάτων

ΔΙΟΙΚΗΣΗ ΨΗΦΙΑΚΗΣ ΕΠΙΧΕΙΡΗΣΗΣ

8^ο ΕΞΑΜΗΝΟ

ΔΙΔΑΣΚΟΝΤΕΣ:

ΚΑΘΗΓΗΤΗΣ ΓΡ. ΜΕΝΤΖΑΣ

Υπεύθυνη Άσκησης: Ξ. Παπαδομιχελάκη

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Σεπτέμβριος 2023

ΕΡΓΑΣΙΑ 4 ΑΝΑΖΗΤΗΣΗ ΚΑΙ RECOMMENDER SYSTEMS

1. ΑΝΑΖΗΤΗΣΗ – TFIDF

Υποθέστε ότι πραγματοποιείτε μια αναζήτηση σε μια μηχανή αναζήτησης με τους όρους "earth, moon, astro". Θεωρείστε σαν μοναδικά δεδομένα της μηχανής τις παρακάτω περιγραφές ταινιών.

α. Χρησιμοποιείστε τη μετρική TF-IDF (χωρίς TF normalization) για να βρείτε ποια θα είναι η κατάταξη των αποτελεσμάτων. Να χρησιμοποιηθεί Cosine Similarity και να ληφθούν υπόψη το κείμενο των τίτλων και οι παράγωγες/σύνθετες λέξεις (Stemming). Σχολιάστε τα αποτελέσματα.

Σημείωση: Το διάνυσμα του query με το οποίο θα συγκριθούν τα διανύσματα των κειμένων δεν είναι το (1,1,1).

2001: A Space Odyssey (1968) PG-13 | 1h 30min | Drama, Mystery, Sci-Fi

G | 2h 29min | Adventure, Sci-Fi

At the "Dawn of Man," a group of hominids encounters a mysterious black monolith alien to their surroundings. To the strains of Strauss's 1896 Also sprach Zarathustra, a hominid invents the first weapon, using a bone to kill prey. As the hominid tosses the bone in the air, Kubrick cuts to a 21st century spacecraft hovering over the Earth, skipping ahead millions of years in technological development. U.S. scientist Dr. Heywood Floyd (William Sylvester) travels to the moon to check out the discovery of a strange object on the moon's surface: a black monolith. As the sun's rays strike the stone, however, it emits a piercing, deafening sound that fills the investigators' headphones and stops them in their path. Cutting ahead 18 months, impassive astronauts David Bowman (Keir Dullea) and Frank Poole (Gary Lockwood) head toward Jupiter on the spaceship Discovery, their only company three hibernating astronauts and the vocal, man-made HAL 9000 computer running the entire ship. When the all-too-human HAL malfunctions, however, he tries to murder the astronauts to cover his error, forcing Bowman to defend himself the only way he can.

The Hitchhiker's Guide to the Galaxy (2005)

PG | 1h 49min | Adventure, Comedy, Sci-Fi

Earthman Arthur Dent is having a very bad day. His house is about to be bulldozed, he discovers that his best friend is an alien and to top things off, Planet Earth is about to be demolished to make way for a hyperspace bypass. Arthur's only chance for survival: hitch a ride on a passing spacecraft. For the novice space traveler, the greatest adventure in the universe begins when the world ends. Arthur sets out on a journey in which he finds that nothing is as it seems: he learns that a towel is just the most useful thing in the universe, finds the meaning of life, and discovers that everything he needs to know can be found in one book: The Hitchhiker's Guide to the Galaxy.

The Martian (2015)

PG-13 | 2h 24min | Adventure, Drama, Sci-Fi

During a manned mission to Mars, passing moon, Astronaut Mark Watney (Matt Damon) is presumed dead after a fierce storm and left behind by his crew. But Watney has survived and finds himself stranded and alone on the hostile planet. With only meager supplies, he must draw upon his ingenuity, wit and spirit to subsist and find a way to signal to the base that he is alive. Millions of miles away, NASA and a team of international scientists work tirelessly to bring "the Martian" home, while his crewmates concurrently plot a daring, if not impossible rescue mission.

Interstellar (2014)**PG-13 | 2h 49min | Adventure, Drama, Sci-Fi**

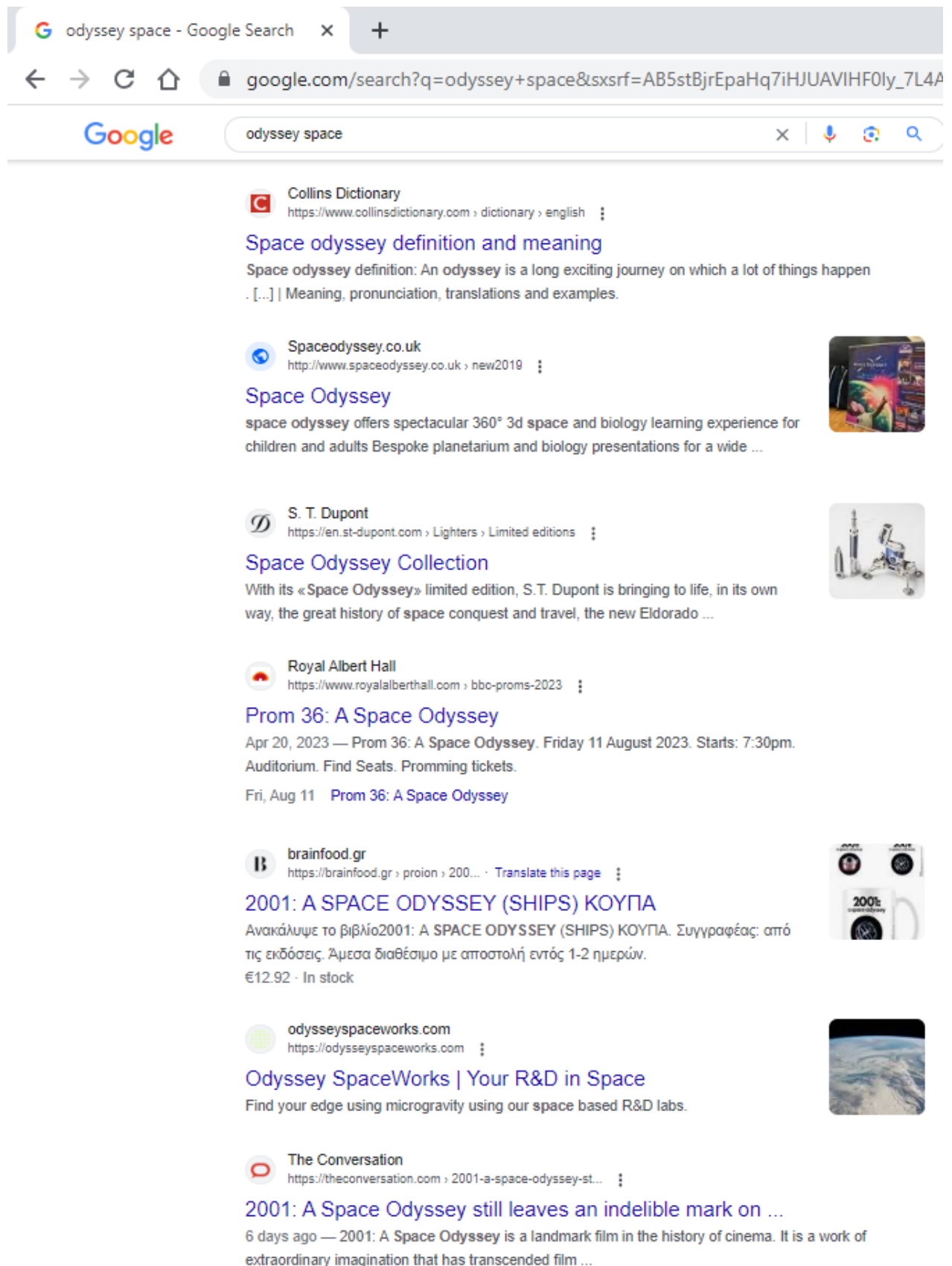
In the near future around the American Midwest, Cooper an ex-science engineer and pilot, is tied to his farming land with his daughter Murph and son Tom. As devastating sandstorms ravage earths crops, the people of Earth realize their life here is coming to an end as food begins to run out. Eventually stumbling upon a NASA base near Cooper's home, he is asked to go on a daring mission with a few other scientists into a wormhole because of Cooper's scientific intellect and ability to pilot aircraft unlike the other crew members. In order to find a new home while Earth decays, Cooper must decide to either stay, or risk never seeing his children again in order to save the human race by finding another habitable planet.

Elysium (2013)**R | 1h 49min | Action, Drama, Sci-Fi**

In the year 2154, two classes of people exist: the very wealthy, who live on a pristine man-made space station called Elysium, and the rest, who live on an overpopulated, ruined Earth. The people of Earth are desperate to escape the planet's crime and poverty, and they critically need the state-of-the-art medical care available on Elysium - but some in Elysium will stop at nothing to enforce anti-immigration laws and preserve their citizens' luxurious lifestyle. The only man with the chance bring equality to these worlds is Max (Matt Damon), an ordinary guy in desperate need to get to Elysium. With his life hanging in the balance, he reluctantly takes on a dangerous mission - one that pits him against Elysium's Astro-Secretary Delacourt (Jodie Foster) and her hard-line forces - but if he succeeds, he could save not only his own life, but millions of people on Earth as well.


2.ΑΝΑΖΗΤΗΣΗ-PRECISION/RECALL

Ενώ ψάχνετε στοιχεία σχετικά με την ταινία «Space Odyssey», η μηχανή αναζήτησης “Google” σας επιστρέφει τα παρακάτω αποτελέσματα.



The screenshot shows a Google search for "odyssey space". The search bar at the top contains the text "odyssey space". Below the search bar, several search results are displayed:

- Collins Dictionary**: A result from <https://www.collinsdictionary.com> with the title "Space odyssey definition and meaning". The description states: "Space odyssey definition: An odyssey is a long exciting journey on which a lot of things happen. [...] | Meaning, pronunciation, translations and examples."
- Spaceodyssey.co.uk**: A result from <http://www.spaceodyssey.co.uk> with the title "Space Odyssey". The description states: "space odyssey offers spectacular 360° 3d space and biology learning experience for children and adults Bespoke planetarium and biology presentations for a wide ...". An image of a book cover is shown to the right.
- S. T. Dupont**: A result from <https://en.st-dupont.com> with the title "Space Odyssey Collection". The description states: "With its «Space Odyssey» limited edition, S.T. Dupont is bringing to life, in its own way, the great history of space conquest and travel, the new Eldorado ...". An image of a pen is shown to the right.
- Royal Albert Hall**: A result from <https://www.royalalberthall.com> with the title "Prom 36: A Space Odyssey". The description states: "Apr 20, 2023 — Prom 36: A Space Odyssey. Friday 11 August 2023. Starts: 7:30pm. Auditorium. Find Seats. Promming tickets. Fri, Aug 11 Prom 36: A Space Odyssey".
- brainfood.gr**: A result from <https://brainfood.gr> with the title "2001: A SPACE ODYSSEY (SHIPS) ΚΟΥΠΑ". The description states: "Ανακάλυψε το βιβλίο 2001: A SPACE ODYSSEY (SHIPS) ΚΟΥΠΑ. Συγγραφέας: από τις εκδόσεις. Άμεσα διαθέσιμο με αποστολή εντός 1-2 ημερών. €12.92 - In stock". An image of a book cover is shown to the right.
- odysseyspaceworks.com**: A result from <https://odysseyspaceworks.com> with the title "Odyssey SpaceWorks | Your R&D in Space". The description states: "Find your edge using microgravity using our space based R&D labs." An image of Earth from space is shown to the right.
- The Conversation**: A result from <https://theconversation.com> with the title "2001: A Space Odyssey still leaves an indelible mark on ...". The description states: "6 days ago — 2001: A Space Odyssey is a landmark film in the history of cinema. It is a work of extraordinary imagination that has transcended film ...".

 **Wikipedia**
https://en.wikipedia.org/wiki/2001:_A_Space_Ody...

2001: A Space Odyssey

2001: A Space Odyssey is a 1968 science fiction novel written by Arthur C. Clarke and the 1968 film directed by Stanley Kubrick. It is a part of Clarke's ...

 **Rotten Tomatoes**
https://www.rottentomatoes.com/2001_a_space_ody...

2001: A Space Odyssey

2001 isn't as much of a film as it is a visual symphony which explores the ideas of the interstellar at a time when the world's interest in space was at an all- ...

★★★★★ Rating: 92% · 118 votes

 **The New Yorker**
<https://www.newyorker.com/magazine/2018/04/23>


"2001: A Space Odyssey": What It Means, and How It Was ...

Apr 16, 2018 — Fifty years ago, Stanley Kubrick and Arthur C. Clarke set out to make a new kind of sci-fi. How does their future look now that it's the past?

 **MUBI**
<https://mubi.com/films/2001-a-space-odyssey>

2001: A Space Odyssey (1968)

A mysterious black monolith encountered by our prehistoric past leaps millennia and connects to a future of colonised space. Where astronaut Bowman is about ...

 **Roger Ebert**
<https://www.rogerebert.com/reviews/2001-a-space-...>

2001: A Space Odyssey movie review (1968)

The fascinating thing about this film is that it fails on the human level but succeeds magnificently on a cosmic scale. Kubrick's universe, and the space ships ...


 **Fandom**
https://2001.fandom.com/wiki/2001:_A_Space_O...

2001: A Space Odyssey (film)

2001: A Space Odyssey is a 1968 science-fiction film directed by Stanley Kubrick. The film was written at the same time as the novel by Arthur C. Clarke.

Release Date: April 3, 1968

Director: Stanley Kubrick

 **Amazon**
<https://www.amazon.com/Space-Odyssey-Stanley-K...>

Space Odyssey: Stanley Kubrick, Arthur C. Clarke, and the ...

It's a fascinating story of how Genius creates. It's not easy, many talented people are pushed to the emotional brink of what they can bear. Some are even ...

★★★★★ Rating: 4.7 · 652 reviews · \$36.19



Odyssey Space Research
<https://odysseysr.com>

Odyssey Space Research, LLC: Home

Dec 14, 2022 — Odyssey Space Research, LLC. 1120 NASA Parkway, Suite 505
Houston, TX 77058 | 281-488-7953. © 2019 Odyssey Space Research, L.L.C. All
rights ...

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Rotten Tomatoes

<https://www.rottentomatoes.com> › 2001_a_space_ody...

2001: A Space Odyssey

Dave Bowman (Keir Dullea) and other astronauts are sent on a mysterious mission,
their ship's computer system, HAL, begins to display increasingly strange ...

★★★★★ Rating: 92% · 118 votes



Indiegogo

<https://www.indiegogo.com> › projects › space-odyssey-t...

Space Odyssey - The Video Game

SPACE ODYSSEY | An awe-inspiring gaming experience of galactic exploration and
colonization. Empowered by the laws of physics and the scientific vision of Neil ...

\$357,866.00



Twitter

<https://twitter.com> › odysseyspaceres

Odyssey Space Research (@OdysseySpaceRes) / Twitter

Odyssey Space Research. @OdysseySpaceRes. Our goal is to get spacecraft and people into
space. odysseysr.com Joined September 2019.



LinkedIn

<https://www.linkedin.com> › company › odyssey-space...

Odyssey Space Research, LLC

Odyssey Space Research, L.L.C. is a dynamic, small business based in Houston, Texas at
NASA's Johnson Space Center (JSC). We provide advanced engineering ...



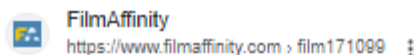
Facebook

<https://www.facebook.com> › OdysseySpaceResearch

Odyssey Space Research

Odyssey Space Research. 39 likes. Our goal is to get spacecraft and people into
space.

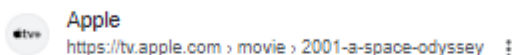




2001: A Space Odyssey (1968)

2001: A Space Odyssey is a film directed by Stanley Kubrick with Keir Dullea, Gary Lockwood, William Sylvester, Daniel Richter, Leonard Rossiter .

★★★★★ Rating: 7.8/10 · 115,102 votes ⓘ



2001: A Space Odyssey

A pair of astronauts heads to Jupiter to investigate a radio signal sent from a mysterious monolith on the moon, but their tranquil trip is endangered when ...



Proms 2023 Prom 36: A Space Odyssey

... music from one of the boldest musical voices of the 20th century, in a Prom inspired by music from Stanley Kubrick's iconic film 2001: A Space Odyssey.

Fri, Aug 11 [Prom 36: A Space Odyssey](#)



2001: A Space Odyssey by Arthur C. Clarke

He is best known for the novel and movie 2001: A Space Odyssey, which he co-created with the assistance of Stanley Kubrick. Clarke was a graduate of King's ...

★★★★★ Rating: 4.2 · 302,468 votes ⓘ



2001: A Space Odyssey still leaves an indelible mark on ...

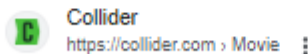
6 days ago — 2001: A Space Odyssey is a landmark film in the history of cinema. It is a work of extraordinary imagination that has transcended film ...



2001: A Space Odyssey

Amazon.com: 2001: A Space Odyssey : Keir Dullea, Gary Lockwood, William Sylvester, Douglas Rain, Arthur Clarke, Stanley Kubrick, Stanley Kubrick, ...

★★★★★ Rating: 4.6 · 8,478 reviews · \$14.99 ⓘ



10 Movies Like '2001: A Space Odyssey'

5 days ago — Fans of Stanley Kubrick's masterpiece 2001: A Space Odyssey will likely love other sci-fi movies like Interstellar, High Life, and Arrival.



NASA (.gov)

<https://mars.nasa.gov/odyssey>

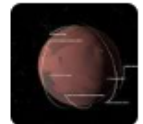
Mars Odyssey Orbiter

Mission Status: Currently Operating. Mars Orbit Insertion, October 24, 2001.

Launched, April 7, 2001. Launch Site, Cape Canaveral Air Force Station, Florida ...

Mission Status: Currently Operating

Mars Orbit Insertion: October 24, 2001



Google

<https://play.google.com/store/apps/details>

Space Chase : Odyssey - Apps on Google Play

Be the captain of the best spaceship, launch your dream of conquering the galaxies.

Join the space exploration team, uncover the endless secrets of the ...

★★★★★ Rating: 3.8 · 2,525 votes · Free · Android · Game



Steam Powered

https://store.steampowered.com/app/Odyssey_The...

Odyssey: The Deep Space Expedition

Odyssey is a story driven space adventure audiovisual single/multiplayer game. Find

a planet that could support life, but in order to get there you have to ...

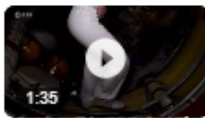
★★★★★ Rating: 6/10 · 10 reviews · \$4.99



European Space Agency

https://www.esa.int/ESA_Multimedia/Videos/2022/10

2022: A Space Odyssey - ESA



Video made during ESA astronaut Samantha Cristoforetti's second mission to the International Space Station, "Minerva". Samantha shared this video on...

European Space Agency - Aug 5, 2022



Denver Museum of Nature & Science

<https://www.dmns.org/visit/exhibitions/space-od...>

Space Odyssey Exhibition Hall

Space Odyssey · Traverse the Sensory Spacewalk in the new Fantasy Spaceship with over 11,000 "stars" that use 43 miles of optical fiber to help you feel like you ...



Instagram

https://www.instagram.com/spaceodyssey_musicspace

Experimental Music Space (@spaceodyssey_musicspace) ...

2151 Followers, 6005 Following, 697 Posts - See Instagram photos and videos from Space

Odyssey - Experimental Music Space (@spaceodyssey_musicspace)



PBS Kids

<https://pbskids.org/cyberchase/space-waste-odyssey>

Cyberchase . Games . Space Waste Odyssey

Fly through cyberspace collecting and sorting trash.



α. Ποια αποτελέσματα αναφέρονται στην ταινία και ποια όχι; Εξηγήστε με συντομία. Ποια από τα αποτελέσματα είναι σωστά(true positive) και ποια λάθος (false positive);

β. Αν γνωρίζουμε ότι υπάρχουν ακόμη 350 αποτελέσματα που σχετίζονται με την ταινία και δεν βρέθηκαν – false negative – υπολογίστε τα παρακάτω

- i. Precision
- ii. Recall
- iii. F-Measure

Σχολιάστε τα αποτελέσματα.

3. RECOMMENDER SYSTEMS

Έξι άνθρωποι αξιολόγησαν τις ταινίες του ερωτήματος 1 με βαθμολογία από 1 (καθόλου καλή) έως 10 (εξαιρετική) και τα αποτελέσματα φαίνονται στον παρακάτω πίνακα. Αντικαταστήστε όπου X τον τελευταίο ψηφίο του Αριθμού Μητρώου σας, αφού προσθέσετε 1

| | 2001: A Space Odyssey (1968) | The Hitchhiker's Guide to the Galaxy (2005) | The Martian (2015) | Interstellar (2014) | Elysium (2013) |
|-----------|------------------------------|---------------------------------------------|--------------------|---------------------|----------------|
| Χρήστης 1 | X | 3 | | 7 | 7 |
| Χρήστης 2 | 7 | 1 | | 2 | 5 |
| Χρήστης 3 | 8 | 2 | 4 | 2 | X |
| Χρήστης 4 | 3 | 3 | 2 | 7 | 3 |
| Χρήστης 5 | | 3 | X | 7 | 6 |
| Χρήστης 6 | 9 | 4 | 5 | 4 | 9 |

- a. Υπολογίστε την ομοιότητα (similarity) μεταξύ των 6 χρηστών χρησιμοποιώντας δυο μεθόδους: Ευκλείδεια απόσταση και Pearson Correlation.
- b. Χρησιμοποιώντας K-Nearest Neighbors με $k=2$ και weighted average και με τις δύο μετρικές του ερωτήματος
 - i. υπολογίστε πως περιμένουμε να αξιολογήσει την ταινία **The Martian** ο χρήστης 2.
 - ii. Σχολιάστε τα αποτελέσματα.
- c. Αν υποθέσουμε ότι χρησιμοποιούμε τις προτιμήσεις των χρηστών στις ταινίες για να προτείνουμε φίλους, τότε ποιες σχέσεις σας φαίνονται πιο πιθανές; Εξηγήστε.