Experimental Evaluation of Algorithms for the Food-Selection Problem

Camil Demetrescu * Irene Finocchi * Giuseppe F. Italiano ◦ Luigi Laura •

Abstract

In this paper, we describe the result of our experiments on Algorithms for the Food-Selection Problem, which is the fundamental problem first stated and addressed in the seminal paper [1]. Because the key aspect of any experimental evaluation is the reproducibility, we detail deeply the setup of all our experiments, thus leaving to the interested eater the opportunity to reproduce all the results described in this paper. More specifically, we describe all the answers we provided to the questions proposed in [1]:

• Where can I have dinner tonight?
• What is the typical Roman cuisine that I should (not) miss?
• Where can I find the best coffee or gelato in town?

Keywords: Carciofi alla giudia, bucatini alla gricia, coratella d’abbacchio, fiori di zucca, mozzarella di bufala, rigatoni alla pajata, bucatini all’amatriciana, spaghetti alla carbonara, saltimbocca alla romana, spaghetti cacio e pepe, trippa alla romana.

I Introduction

Eating is one of life’s greatest pleasures, especially in Rome. Thus, the general advice recommends foreigners to be adventurous and to follow the well-known maxim:

When in Rome, do as the Romans do.

Unfortunately, previous experimental evidence suggests that this approach may not even lead to a feasible solution in finite time because of convergence problems. Indeed, there is an incredible variety of eateries, especially in districts such as Testaccio, Trastevere, Campo de’ Fiori, Piazza Navona, or the Ghetto. The problem of selecting a good restaurant seems therefore of practical importance in this mouth-watering scenario.

In this paper we present the experimental evaluation of the algorithms for the food selection problem originally presented in [1]. These algorithms are based on fundamental algorithmic techniques including random sampling, divide et impera (sorry guys, but we are in Rome!), local search, hill climbing, and the greedy approach, and require only constant time. However, given that every month is high season for tourism in Rome, if you don’t plan in advance you may be forced to use backtracking (the restaurant may be full or closed): this occurrence could increase considerably your running time.

II Local Search

Well, it’s VIII PM and SEA sessions are over. You feel so hungry that even power-law graphs look like fettuccine. Local search seems the appropriate technique to apply in this case. Like any good Roman district, you will not be spared by the wealth of great restaurants, trattorias and pizzerias around the SEA venue. We enumerate now all the solutions we found using a simple local search algorithm. All the solutions can be easily reached on foot (in XV minutes or so, depending on hunger pangs) even if you don’t like walking or if you are not very good at computing shortest paths: see Figure I.

R1 Il Patio Pizzeria. Via Labicana 29, ph: 06-7003406. Here you should definitely try their gnocchi with cheese!

R2 Vecchia Roma (Old Rome). Via Ferruccio 12c, ph: 06-4467143, closed on Sunday. Don’t miss the bucatini all’amatriciana served in a hollow pecorino cheese.
R3 Naumachia, V. Celimontana 7, ph: 06-7002764. A must is their hand-made pasta with a soft sausage sauce.

R4 Hostaria Isidoro, San Giovanni in Laterano 59, ph: 06-7008266. If you like pasta, this place is a good choice for you!

R5 Hostaria da Nerone, Via delle Terme di Tito 96, ph: 06-4745207, closed on Sundays. This is a tiny, friendly restaurant.

R6 La Pace del Cervello (The Rest of the Brain), Via Dei Ss. Quattro 63, ph: 06-7005173. This is a (good!) pizzeria and a pub; it is open up to late night.

R7 Beer House, Via Merulana 109, ph: 06-7096265. It is a pub with home made roman cuisine! Very close to conference venue!

R8 Il Grillo Brillo (Drunken Cricket), Via dei serpenti 79, ph: 06-4883029. Good meat and fish.

R9 Kick-Off, Via Delle terme di Traiano 4, ph: 06-48904343. This is a pizzeria, a pub, and it has also two regular five-a-side soccer fields, just in case you want to play soccer before eating!

R10 Pizzeria Borgia, Via Cavour 215, ph: 06-4743538. Good pizzeria, with an inside garden.

R11 Robin Hood, Via Cavour 162, ph: 06-48903511. Here you can try their famous “Pizza Show”: a complete dinner all served on top of pizzas!

R12 Carbonara, Via Panisperna 214, ph: 06-4825176, closed on Sundays. Traditional roman dishes, nice atmosphere, in the famous street that gave its name to the Via Panisperna boys, a group of young scientists led by Enrico Fermi; here in 1934 they discovered the “slow neutrons.”

R7 Al Giubileo, Via del boschetto 44, ph: 06-4818879. Here they serve “pizza no stop”: all you can eat pizza!

R14 Pizzeria Chicco Di Grano, Degli Zingari 6, ph: 06-47825033. Tuscany style restaurant in the middle of Rome!
III Hill Climbing

Hill climbing appears to be a very promising approach: to understand why, let’s review a little bit of history on the VII Hills of Rome. Tradition says that Rome was founded in DCCLIII (753) BC by twin boys, Romulus and Remus. Romulus and Remus were abandoned by their parents, put in a cradle and sent off to be drowned on the Tiber river. The boys were found by a she-wolf who took care of them as if they were her own cubs. (We remark that all of this happened well before Mowgli appeared.) When the boys grew a bit older, a shepherd found them: he and his wife raised them to be young men. At that point, the twins set out on a quest: on their way they found a beautiful land with seven hills, which they named Palatine (Palatino), Aventine (Aventino), Capitoline (Campidoglio), Quirinal (Quirinale), Viminal (Viminale), Esquiline (Esquilino) and Caelian (Cecilio). They were very excited: but, who would rule that piece of land? To determine this, Romulus stood on the Aventine hill and Remus stood on the Palatine: whichever hill the birds flew over, that brother would rule the land. It was said to be a message from the gods. After a long time, six birds flew over the Palatine hill where Remus was standing, and so he thought he would rule, until twelve birds flew over the Aventine hill where Romulus stood, and Romulus ended up ruling Rome.

Nowadays, the seven hills, the valleys in between, and some other hills such as Janiculum (Gianicolo, rising above Trastevere) and Pincian (Pincio, rising above Piazza del Popolo) represent just the central part of the city (Centro Storico), in which you will find the main monuments, archeology sites, wonderful views, museums, and fine restaurants. But don’t be scared about climbing Rome’s hills: they aren’t that big after all! Some restaurants and trattorias in central Rome are listed below.

R16 Antico arco, Gianicolo, Piazzale Aurelio 7, ph: 06-5815274, closed on Sunday (A2)
R17 Arancia blu, San Lorenzo, via dei Latini 55-65, ph: 06-4454105, vegetarian (east of C2)
R18 Da Armando al Pantheon, Centro Storico – Pantheon, salita de’ Crescenzi 31, ph: 06-68803034, closed on Sunday (B2)
R19 Da Benito e Gilberto, Vaticano, via del Falco 19, ph: 06-6867769, closed on Sunday/Monday, very good fish (A1)
R20 Caffè Mancini, Centro Storico – Campo Marzio, via Metastasio 21, ph: 06-6872051, closed on Sunday, once in the centre, reach it by walking along some of the most characteristics streets in Rome (B2)
R21 La Campana, Centro Storico – Campo Marzio, vicolo della Campana 18, ph: 06-6867820, closed on Monday, some people say this is the most ancient restaurant in Rome... (B2)
R22 Camponeschi, Centro Storico – Campo De’ Fiori, Piazza Farnese 50/50a, ph: 06-6874927, closed on Sunday, historical Roman restaurant in a wonderful location, expensive (A2)
R23 Checchino dal 1887, Testaccio, Via di Monte Testaccio 30, ph: 06-5743816, closed on Sunday/Monday, another historical Roman restaurant (A2)
R24 Checco Er Carrettiere, Trastevere, Via Benedetta 10, ph: 06-5800985, closed on Sunday (A3)
R25 Il Convivio, Centro Storico – Navona, Vicolo dei Soldati 31, ph: 06-6869432, closed on Sunday, very good restaurant, expensive (A2)
R26 Dar Cordaro, Trastevere, Piazzale Portuense 4, ph: 06-5836751, closed on Sunday/Monday (A3)
R27 Il Drappo, Centro Storico – Campo De’ Fiori, Vicolo del Malpasso 9, ph: 06-6877365, closed on Sunday, Sardinian cuisine (A2)
R28 Gaudi, Parioli, Via R. Giovannelli 8, ph: 06-8845451, pizza (north of C1)
R29 Da Giggetto al Portico d’Ottavia, Antico Ghetto, Via Del Portico d’Ottavia 21/a, ph: 06-6861105, closed on Monday (B2)
R30 Hostaria degli Artisti, Esquilino, Via G. Sommeiller 6/8, ph: 06-7018148, Neapolitan cuisine (C2)
R31 Matricianella, Centro Storico – Campo Marzio, via del Leone 2/4, ph: 06-6832100, closed on Sunday, authentic Roman cuisine at convenient prices (B2)
R32 La Penna d’Oca, Centro Storico – Popolo, via della Penna 53, ph: 06-3202898, closed on Sunday, for hard to please gourmets (B1)
R33 Dar Poeta, Trastevere, Vicolo del Bologna 45, ph: 06-5880516, very good pizza (A3)
R34 Sora Lella, Centro Storico – Isola Tiberina, Via di Ponte Quattro Capi 16, ph: 06-6861601, famous restaurant in a position unique in the world (B2)
R35 Tram Tram, San Lorenzo, Via dei Reti 44, ph: 06-490416 (east of C2)
### A1
Prati - San Pietro - Castel Sant'Angelo - Vaticano

### A2
Piazza Navona - Piazza Farnese - Campo De' Fiori
Via Giulia - Gianicolo

### A3
Trastevere - Testaccio

### B1
Piazza di Spagna - Via Veneto - Via Condotti - Tritone

### B2
Quirinale - Fontana di Trevi - Fori Imperiali - Mercati Traianei
Forte Romano - Piazza Venezia - Campidoglio - Pantheon
Via del Corso - Isola Tiberina - Campo Marzio - Antico Ghetto

### B3
Aventino - Circo Massimo - Bocca della Verità
Piramide Cestia - Porta San Paolo

### C1
Villa Albani - Via XX Settembre - Porta Pia
Galleria Borghese - Terme di Diocleziano

### C2
Stazione Termini - Santa Maria Maggiore - Via Nazionale
SEA 2012 venue - Via Cavour - San Pietro in Vincoli - Piazza Vittorio
Colosseo - San Clemente - Domus Aurea - Esquilino

### C3
San Giovanni - Terme di Caracalla - Porta Latina

#### Figure III. Lookup table used in the geometric approach of Section IV

|   |   |   |
|---|---|---|
| A | B | C |
| 1 |   |   |
| 2 |   |   |
| 3 |   |   |

#### Figure II. Geometrical decomposition used by our divide et impera food selection algorithm (see Section IV).

R36  *Il Tulipano Nero*, Trastevere, Via Roma Libera 15, ph: 06-5818309, good pasta and pizza (A3)

In spite of the restaurants above, you might still want to experiment with international cuisine:

I 1  *Hang Zhou*, Esquilino, Via Principe Eugenio, 82, ph: 06-4872732, Chinese (C2)

I 2  *Isola Puket*, Quartiere Africano, Via di Villa Chigi 91, ph: 06-86212664, Thai (north of C1)

I 3  *Jaipur*, Trastevere, Via San Francesco a Ripa 56, ph: 06-5803992, the best Indian restaurant in town (A3)

I 4  *Thien Kim*, Centro Storico – Campo De’ Fiori, Via Giulia 201, ph: 06-68307832, Vietnamese (A2)

#### III. i  Corollaries

After lunch or dinner, you can have a tasty gelato in one of the following celebrated “gelaterie”:

G1  *Il Gelato di San Crispino*, Centro Storico – Tritone, Via Della Panetteria 42, ph: 06-6793924, closed on Tuesday (B1)

G2  *Al Settimo Cielo*, Prati, Via Vodice 21a, ph: 06-3725567, closed on Monday (A1)

G3  *Giolitti*, Via Degli Uffici del Vicario 40, ph: 06-6991243 (B2)

... or you can drink a coffee at the following cafes (but please, remember, you are not supposed to order a cappuccino in Italy after noon!):

C5  *Caffè Sant’Eustachio*, Centro Storico – Piazza San Eustachio, Via della Fontanella di Borghese 59 / Piazza San Lorenzo in Lucina 29 (B2)
**IV Divide et Impera (Divide and Conquer)**

Well, you know that Rome wasn’t built in a day, and when the input size gets large, divide et impera can yield good results. To apply the technique, divide the map of Rome into IX squares having approximately the same area, as shown in Figure II. Based on your taste and preferences, choose an area where you would like to have dinner (e.g., area B2) and find the corresponding entry in the lookup table given in Figure III. Scan the list of restaurants of Section III, discarding those not located in any of the areas listed in the selected lookup table entry. Choose a restaurant among the remaining ones: if the list of remaining restaurants is empty (don’t panic: this is a low probability event), return “Error # MCCLXXIX: Diet suggested.”

**V Random Sampling**

If you choose a restaurant uniformly at random from the lists given in Section II and in Section III you can still expect a reasonably good solution.

**VI The Greedy Approach**

If you want to try authentic Roman cuisine, look for the following dishes when you order (especially in traditional restaurants such as “trattorie” and “osterie”). A short guide can be probably helpful in order to get oriented:

- **Carciofi alla Giudia**: Roman-Jewish style artichokes, a must! You can have them in many Kosher restaurants in the Ghetto.

- **Spaghetti cacio e pepe**: the real traditional roman dish: pasta topped with grated pecorino Romano and ground black pepper. It is also the favorite dish of Francesco Totti, the world-known football player of A.S. Roma, the football team of the city.

- **Abbacchio alla scottadito, abbacchio al forno**: “burned finger” lamb, roasted lamb.

- **Filetti di baccalà**: deep fried cod.

- **Fiori di zucca**: courgette flowers, typically stuffed with mozzarella and anchovies.

- **Bucatini all’amatriciana**: pasta topped with tomato sauce, pancetta and a touch of black pepper.

- **Bucatini alla gricia**: pasta topped with guanciale, pecorino cheese and a touch of black pepper.

- **Spaghetti alla carbonara**: pasta topped with egg, parmesan cheese, pancetta and black pepper.

- **Saltimbocca alla romana**: “JumpInMouth” Roman style, a thin fillet of veal topped with a slice of cured ham, white wine and sage.

And now, these are for the really adventurous people:

- **Trippa alla romana**: tripe Roman style.

- **Rigatoni alla pajata**: pasta made with young veal calf intestines.

- **Coda alla vaccinara**: stewed oxtail.

Among other Italian foods that are worth trying, we also recommend:

- **Appetizers**: bruschetta, crostini, supplì, mozzarella di bufala, olive ascolane, antipasto all’italiana.

- **Main courses**: tortellini or ravioli with meat (ringlets of dough filled with seasoned minced meat, typical from Bologna), trofie al pesto (a special recipe from Genoa), fettuccine alla boscaiola (fettuccine with mushrooms and peas), spaghetti alle vongole (pasta with clams).

- **Desserts**: tiramisù (“PickMeUp,” with coffee and mascarpone, an Italian soft cheese), cannoli or cassata siciliana (Sicilian pastry filled with cream and buttermilk curd), babà napoletani (Neapolitan sponge-cake steeped in rum syrup), torta della nonna (grandma’s cake, typically with cream and pine seeds).

**VII Experimental Evaluation of Pizzas in Rome**

In Figure IV we report the results of our experiments on the thickness of the pizzas we tried in Rome. We refer only to the pizzas made in specialized restaurants, called *pizzeria*, where the pizza is served in dishes and it has the

---

*We refer the interested eater to Appendix I for details about the famous Fettuccine Alfredo.*
traditional round shape. On the other hand there are many
take-away shops called pizza a taglio, where the pizza is
prepared in long, rectangular baking pans. It is important
to mention that the pizza in pizzerie is mostly cooked in a
wood-fired oven, while in pizza a taglio shops they usually
cook it in an electric oven. As we can see from the plot,
more than 70% of the pizzas is less than one centimeter
thick, and the remaining is much taller. It is interesting to
notice that almost no intermediate thickness value has been
found in our experiments. This confirms that in Italy there
are two different kind of pizzas: the romana (roman) one
and the napoletana (neapolitan). Here we summarize our
main findings:

- The pizza romana, besides being thinner, has a crispy
  base. On the opposite side, the pizza napoletana has
  soft and pliable bases.

- In Rome the pizza toped with tomato, mozzarella, an-
  chovies, and oil is called Pizza Napoletana\(^6\). In Naples
  the same pizza is addressed as Pizza Romana\(^6\). Sur-
prisingly, there is no Pizza Romana in Rome and no
Pizza Napoletana in Naples!

- If you are from outside Italy and you like the “pepper-
  oni pizza,” don’t ask for the “pizza con i peperoni”—
  that is, pizza with peppers! The proper name is “Di-
  avola.”

VIII Drinking Wine

There is some experimental evidence that drinking alco-
holic beverages during conference sessions can improve
the appreciation of the talks (see also the related Ballmer Peak
shown in Figure [V]): results vary significantly whether the
speaker, the audience or both are drinking (in a famous talk
from FUN 2004 conference both the speakers and a large
portion of the audience were drinking beer, that was dis-
tributed by the speakers (authors) that explained it by say-
ing: “we were drinking beer when we wrote this paper, and
we think you should drink beer too when you listen to this
talk”).

We don’t have enough space here to discuss this issue
but, if you plan to taste wine during SEA, we suggest the
following list of enotec\(\text{a}\)\(^{\text{i}}\) and wine bars in Rome:

W1 *Trimani*, Via Cernaia, 37, ph: 06-4469630 (C1). This
is probably the most famous roman enoteca, whose
roots date back to 1821. Here they only sell wine, but
there is also *Trimani Il Wine Bar*, Via Cernaia, 37, ph:
06-4469630, where you can taste wine and eat (C1)

W2 *Ai tre scalini*, via Panisperna, 251, ph: 06-48907495.
Please note that this place, besides being there since
1895, it is in the street that gives his name to the fa-
mous Via Panisperna boys, the group of young scient-
ist led by Enrico Fermi, that in 1934 discovered the
slow neutrons (B1)

W3 *Cavour 313*, Via Cavour, 313, ph: 06-6785496. It has
a very large selection (C2)

W4 *Gusto*, Piazza Augusto Imperatore, 9, ph: 06-3226273.
It has also a restaurant and a kitchen good store (A2)

W5 *Il pentagrappolo*, Via Celimontana, 21b, ph: 06-
7096301. This is a wine music bar (C3)

W6 *Cul de Sac*, Piazza di Pasquino, 73, 06-68801094. This
is another very famous place in Rome (A2)

If you prefer to drink beer, you can not miss the
*Beer House*, Via Merulana 109 (it is very close to the SEA
venue - R7 in Figure [I]). Here, besides many types of beers,
you can enjoy the traditional home made roman cuisine that
is well defined by the sign just above the door: *cucina mi
madre* that, in roman slang, means “my mother is the chef”
(but we know that there is always something lost in transla-
tion). They have also free WiFi.

We conclude by suggesting the nice (and very little!):

W7 *Caffè letterario Aquisgrana*, via Ariosto 28-30

that is very close to the SEA conference venue (few me-
ters away): here you can taste not only wine, but also many
beers and some traditional medieval alcoholic beverages:
sidro, iodromele and ippocrasso! The last one, ippocrasso,
is hand made by Simona and Patrizia, the owners of this
place that offers also a small selection of books as well as
handbound notebooks. And there is free WiFi!

IX Eating SEAfood during SEA

If you want to experiment SEAfood during the SEA con-
ference, we provide a small list of restaurant below; how-
ever, if you also want to look at the SEA while eating

\(^{i}\)The italian term *enoteca* literally means “wine repository,” and de-
notes a store in which you can buy wine; in many *enoteche* it is also possi-
ble to taste wine like in a wine bar.
SEAfood during the SEA conference, i.e., the full experience, the recommended venue is Fiumicino, the small city on the coast near to Rome, close to the airport that bears its name.

S1 *Baia Chia*, Via Machiavelli, 5, ph 06-70453452. Very close to the conference venue.

S2 *Mater Matuta*, Via Milano, 47, ph: 06-4823962. Also in walking distance from the conference venue.

S3 *Su Nuraghe*, Via Imperia, 66, ph: 06-44291846. It will serve you more food than you can eat!

S4 *Ragno d’Oro*, Via Silla, 26, ph: 06-3212362. Small, remember to book before you go!

S5 *Rosetta*, Rosetta, 8, ph: 06-6861002. Very very very expensive. Don’t say we didn’t warn you!

**X Concluding Remarks and Open Problems**

We think that our experimental results should provide a good insight to the problem addressed so far. However, more experiments are needed for various related problems. For example, when a large group is at the end of a nice dinner, and a cake is served, what is the right strategy? This problem has been addressed in [2][3], but we strongly believe that is missing an experimental validation of the theoretical results presented in the above papers. We hope that SEA participants will contribute in this direction. Accord-
ing to our experimental study done by the authors, the tested algorithms appear to achieve very good approximation ratios: the typical outcome of the experiments is exemplified in Figure VI.

And to conclude, Horatius would say:

\[
\text{Nunc est bibendum,} \\
\text{nunc pede libero pulsanda tellus}
\]

“Now it is the time to drink, now it is the time for the loose feet to hit the floor” (Horatius, Carmina 1, 37).

References

[1] Camil Demetrescu, Irene Finocchi, and Giuseppe F. Italiano. Approximate Solutions to the Food-Selection Problem (or How to Pig Out in the Eternal City).

[2] Sven O. Krumke, Maarten Lipmann, Willem E. de Paepe, Diana Poensgen, Jorg Rambau, Leen Stougie, and Gerhard J. Woeginger. How to cut a cake almost fairly. In the Proceedings of the thirteenth annual ACM-SIAM symposium on Discrete algorithms (SODA ’02).

[3] Jeff Edmonds, Kirk Pruhs. Cake cutting really is not a piece of cake. In the Proceedings of the seventeenth annual ACM-SIAM symposium on Discrete algorithms (SODA ’06).

Appendix I

Wanna know the real story behind Fettuccine Alfredo? In MCMXIV (1914) a small restaurateur living above his small Rome restaurant was faced with a problem no respectable Roman could endure: the loss of his wife’s appetite. Many months pregnant, Alfredo di Lelio’s wife refused all her husband’s best dishes. Watching his wife grow weaker, Alfredo made a vow: “I’ll invent something so tasty that she will immediately succumb to temptation,” remembers Russell Bellanca, co-owner of the U.S. branches of Alfredo the Original of Rome. So late one night in his tiny kitchen, Alfredo dropped a handful of fresh fettuccine egg noodles into a pot of boiling water. He melted butter and Parmegiano Reggiano cheese, and then he mixed in the pasta. Fettuccine Alfredo was born! His wife cleaned her plate, and a short time later, Alfredo II was born to the music of customers downstairs in Alfredo’s I’s restaurant, all crying for his new irresistible dish. Today, of course, the original Alfredo’s in Rome, which is in Piazza Augusto Imperatore, is lorded over by Alfredo the III. Amazingly enough, nowadays fettuccine Alfredo are more known in the U.S. than in Rome: there are branches of Alfredo’s in Manhattan and Miami Beach, as well as in Disney World’s Epcot Center.