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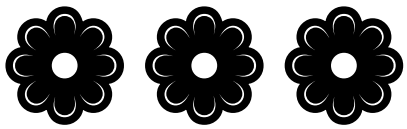

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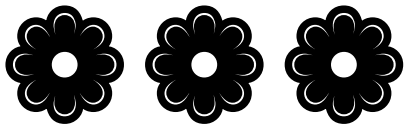

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Applications of
Modern Mathematics
to the Mastery of
The Quotidian Dilemma

II. The Hotel Quagmire

"When in doubt, go to the best hotel"· *Isadora Duncan*

You are in charge of the branch office of an American publishing house in some foreign country, France for convenience sake though it could just as well be anywhere. When you came here fourteen months ago, you spent a few months just shopping around until you rented a 4-room suite in the Hotel Grothendieck. When you first moved in you didn't realize you would be staying so long; you might have gotten a lower rate by contracting for the year.

Forethought and intelligence were apparent in your choice of location, on the Rue Mormoiron , away from the bustle of the big city yet within walking distance of the attractions of the downtown . You knew the city well and avoided the tourist traps, the flea bags, the haunts for disreputable activities. Its' a colorful street, this part of the rue Mormoiron in the *XV^ième Arrondissement* , with its mix of shops, little restaurants, café-tabac, bureaucrats , foreigners, loving couples, street characters, clochards. The traffic can be noisy ; your suite being up on the 5th floor, you are not unduly disturbed by it.

The bathroom is acceptable by modern standards, linens and towels provided, the rooms cleaned and bed made up at regular intervals. Even here , the insidious influence of Americanization is present : the Grothendieck provides bars of soap! The management is collective: owners, grandmother, brothers, a sister, cousins; all one family. It is not some faceless bureaucracy that is charged with your

well-being , not some distant corporation deciding your fate. Humanity overrules the profit motif [1] - you're among friends.

Do you have some problems we haven't heard about? Come into the office and talk them over. Would you like an expresso? Courtesy of the establishment. Jacques, my older brother is away for the afternoon. I can perhaps be of service? You're one of our best customers! Don't think you're going to be pushed out onto the street if you fall behind in your payments for a few weeks - even a month! No, the rent is not about to go up. If and when it does you'll be told months in advance. We can always work out something.

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You've been there a year , and everything's been satisfactory. You receive a paycheck in the mail about once each week. If for some reason it's held up, the next check covers the full two weeks'. You weren't sure at first that you could trust the postal service. Now you realize that, provided it or some relevant division of the Civil Service isn't on strike, [2] , it functions better than the US Post Office. Most delays and mix-ups are caused by the mishandling of mail over there.

You've settled in ; perhaps too much: hard yet challenging work, good friends, restaurants, bookstores; concerts, plays, strolls through the parks; frequent trips to the countryside and the beach; vacations in Italy, Spain, Morocco, Greece. You entertain, hold small parties. You make a serious effort to improve your command of the language. Life is good.

The first intimations of trouble surface gently, like the moist breezes that, circling like wizard's wands, presage a distant storm.

No check comes during the first week in November. You dip into your

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[1] **sic**

[2] **a big proviso**

savings. The next week's check is less than the full amount for two weeks. The check after that is insufficient to make up the difference. A pattern of irregularity sets in that will plague the rest of the winter. Only in late February do you make the calculations that reveal that you've given the Grothendieck well over thousand dollars that has yet to be reimbursed by the company.

You're a practical man at heart, quite different from the glint-eyed daydreamer inventing you, and you arrange at once to have a talk with the hotel management. You meet with the father himself; he's one who makes the final decisions. You start to discuss taking a cheaper apartment. At this stage you've no intention of moving out, but that, also, should be considered an eventual option.

- Nonsense, my friend! We like you here. We want you to stay! You don't keep late hours, you don't make noise, nobody ever comes to us with complaints about you. You pay your bills on time, its' people like you who attract a higher class of clientele.

- Here, use the telephone. He picks up the receiver, dials the code for international long distance, and hands it over.

- Call the company at home. The hotel will pick up the bill.

Because of the time difference you reach your supervisor just as he is about to go off for the day. You explain the situation. He tells you not to worry. There's been some oversight. How much was the amount? $2000? That's not much, that's less than a months' salary. He promises to instruct the accounting office the next morning to send a check to cover the deficit.

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We are in mid-March. Still no supplementary check. Another two weeks; even your regular paychecks aren't coming! A frantic call to headquarters . There is less confidence in the supervisor's tone of voice.

A new word , 'restructuring', is swimming around in the conversation. Let's put it this way, there's been some playing of musical chairs in the upper administration, even some layoffs of vice presidents and other top level executives. Go pick up a copy of the Herald Tribune and study the stock market reports. No one's honest enough yet to use the words, 'financial crisis' , but to be frank the company is in some sort of trouble. There is *absolutely* no cause for alarm: your job is *secure* . Someone will *always* be needed to run the French office. Is it too much to ask to wait another two weeks? If you don't hear anything by then, *call again* .

With many variations, and increasing turbulence, this format will continue through the next 3 months. Paychecks do arrive : on time, a week , or at most two weeks , late. Somehow the company never does seem to end up paying you your full salary. And, too, you have gradually built up a debt with the hotel. Now you owe a full month's back rent .

You balk at dipping into your tight reserves at the bank: the future has suddenly begun to look bleak. It is undeniable that the mood at the reception desk has perceptibly chilled. The younger sister greets you with a cryptic 'bonjour', then tells you that they would very much appreciate it if you would have something to show them by the end of July.

Desperate calls to headquarters are now being made on the average of once a week . A new voice over the line; you don't recognize it. Not hostile, not very friendly; all business, lots of jargon. For the very first time you're hearing that the company's been bought out in a merger ! There have been numerous demotions, layoffs, firings. Your former supervisor was one of the first to get the ax. One good piece of news: *your* job is safe! Your paycheck was sent out - (just a moment while I make a call down to accounting) - *hello, are you still there?* - two days

ago. Tell the hotel that the debt will be cleared up once things settle down .

Jubilation! The letter arrives, as promised. The desk clerk shakes your hand while passing it over to you . You go upstairs to your rooms, sit on your couch and open it. Horror clutches you at the entrails : you have been placed on half-time! Henceforth the Paris office will be open only in the mornings, and then only by appointment .

The slip of paper you hold in your hand is the last full-time paycheck you'll be receiving. One more thing - the new corporate owners do not intend to pay you the $10 ,000 owed you by your former contract. You are welcome to sue the company, but you ought to recognize that a lawsuit is bound to cost you much more than the sums, if any, you might regain.

A few days later you are rushed to the American Hospital in Neuilly for an emergency operation. The remainder of your savings go up in smoke. There is, in addition, a new burden of debt. But you are not easily ruffled.

Back in your suite the next week , over coffee and croissants , you calmly review the options . They're really very simple: you must move to another hotel.

Entering the hotel quagmire

All courses of action depend upon a frank exposition of your situation to the hotel management . You assemble some papers, take the lift down to the first floor and ask to speak with the owner. He tells you to wait while he calls in the rest of the family . His manner is distrustful, suspicious. Among the rest of them you arouse varying degrees of sympathy , but you know that they will not go against him.

He is adamant on one point: you will not be allowed to move until at least $2,500 of the $ 3,000 you owe them is paid. How long has it been

since you began leading them down the garden path? Six months? A year? Why should they believe you now, when you've disappointed their expectations so many times? You show him the bill from the hospital. That's not his concern, he says. The younger brother, always friendly to you, asks his father to show a little heart: a ruptured appendix isn't your fault . You show them the letter from your company, instructing you to close down your office.

The ancient grandmother rises up on her two canes , and with a free hand disdainfully pushes it back in your face: it's written in a foreign language, they wouldn't understand a word of it! You could tell them anything, and how could they know if it were true or not! She's had a long, hard life. She can tell you what it's like ,washing cold paving stones on your knees from dawn to dusk . She's learned never to trust foreigners :Germans, Americans, Algerians, Spanish . All the same!

After some discussion between them, it is decided that no legal action will be taken against you and you will be allowed to stay, provided you keep up your regular weekly payments on the room. Don't forget that the debt will have to be paid soon !

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You have now entered the community of untold thousands of beings throughout history: the longer you stay the more you owe; the more you owe the harder it is to leave. The only way to make the money to pay your bill is to go elsewhere , but the management will not let you do this. Each day the bill goes up; but it is the bill that is keeping you there.

The hotel quagmire is not so much an economic difficulty as an emotional condition. The experience of being trapped in a room beyond your means, because you can't make good on what you already owe,

must be lived to be understood. Reactions are of two kinds: the desperation response , the response of despair.

Mere desperation tends to stimulate the tenant to raise the money by any means at his disposal, not stopping short of bank robbery. Despair, coming from the conviction that he is trapped and his cause hopeless, can lead to seemingly irrational behavior: since there's nothing he can do to escape his dungeon, what prevents him from going out and spending his last penny on a good time?

I , sadly enough tend to be in the latter encampment. My exceptional insights into the elaborate mechanisms of ploy and counter-ploy that can emerge when the situation has degenerated into its final stages, has all been derived from first-hand experience.

Tenant's Options:

(1) Windfall of money that pays off the debt. (The Marx Brothers in "Room Service")

(2) Jumping the rent when the desperation pressure , $\Delta^* P(t)$, rises above a threshold known as the 'lower critical platform' , LCP, or ν_{max}. This is the occasion of the first stirrings of desperation in the mind of the *tenant* . It can be several weeks away from the *Γ-point* . (See below)

(3) Keeping the desperation pressure below the "modulus of initiative activation", MIA, or ζ . This is the first critical state of perceived tension between tenant and landlord at which *management* may consider take several of the steps listed under the landlord's options.

(4) Calling in Legal Aid, tenant's unions, rent control boards, etc., to delay or forestall eviction proceedings. Political sex appeal, which the character in our story doesn't have, helps .

(5) Having landlord warned or arrested for aggravated threats and/or violence.

(6) Moving luggage in small amounts to storage lockers in the nearby train station. An example of how this might be done will appear someday in the memoirs of Lisker, R. A variant is to store all valuables with a sympathetic friend who lives in the same hotel.

(7) Calculation of the Γ-point , or *point of no return* . This is the date beyond which there exists no further option other than jumping the rent, otherwise known as flight . It is primarily a function of the ADC, or "absolute debt ceiling", Ψ , the largest amount the landlord will allow you to owe to the hotel. Other factors may also intervene. Knowing this date makes one more effective in all one's eventual stratagems.

(8) Throwing luggage from the windows at 3 A.M. some night and clambering down from the fifth floor on a knotted sheet. (These things only happen in the movies, though I have read that Richard Wagner pulled off something almost as dramatic in Vienna with a waiting horse -cart.)

(9) Refusing to leave the room, even when it is locked from the outside. (The painter-novelist Frederick Rolfe (Baron Corvo) tried this. The landlord and his wife picked up the bed with him in it and dragged it out into the street.)

(10) Marrying the landlord's daughter, thereby becoming part of management. His troubles now move to the landlord's list .

(11) A providential earthquake that destroys the hotel, thereby absolving the debt. This is sometimes known as the $\delta.\varepsilon.\mu.$ *factor* , or "deus ex machina". A war can accomplish the same thing. Wars can be a blessing for certain kinds of homeless people, particularly if they are

lucky enough to wear some kind of uniform. (It is instructive to see what the novelist Hugh McLenehan does with this in "Barometer Rising".)

Landlord's Options

(1) Harass tenant, make him feel he's not welcome until the rent is paid up.

(2) The reverse strategy: Treat him like an honored guest lest he contemplate any of the possibilities in the above list.

(3) After several warnings , store his luggage and all personal items in the attic and put locks on the door. There is always the risk that the tenant may anticipate this move and empty out the room, an item at a time, over the last few weeks.

(4) Issue no warnings, just put locks on the doors. Make sure that the tenant has not already contacted a lawyer. Even in France there are some laws against this sort of thing, though you'll never see them printed on a card hanging over the bed .

(5) Do nothing until he tries to bolt, then have him arrested. Americans can always find money .

(6)) Ignore it: life is too short to have nervous breakdowns.

(7) Take him to court

(8) Tell the tenant to clear out immediately and cancel the debt.

(9) Calculate the landlord's Γ-point ,which may be different from the tenant's Γ-point , then forget about the whole thing until the moment arrives. This gives peace of mind beforehand, and assists decisive action afterwards.

(10) Declare bankruptcy and move out, leaving the tenant alone to handle taxes, fuel, electricity, repairs, tenant's complaints, unpaid bills and overdue rents , legal actions, visits from the board of health, fines for fire violations, pay-offs to politicians, cops and gangsters, fluctuations

in property values , your screaming mother-in-law, and the vagaries of the tourist trade .

(11) Invite the tenant out for a long night on the town. You both get drunk and thrash out your differences.

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The Mathematics of the Hotel Quagmire

The normal assumption is that the rent rises linearly. Hotels may lower their rates if rooms are rented by the month or year, but one can still compute a daily rent rate , ρ . The amount of rent that is expected by day t is therefore ρt. The total debt is then:

$$A(t) = \rho t - \int_0^t \varpi(s)\,\tau(s)ds + K$$

where:

ρ is the *predetermined incremental multiplier* (PIM), otherwise known as the rent.

τ (s), sometimes called the *reactive density* or *reactivity* , is the amount of money paid out to the hotel on day s.

ω(s) is a weight-factor which is a function of the ratio of the exchange rates between the tenant's country of origins and present country of residence.

Calculations are greatly simplified by letting $\mu(s) = \varpi(s)\,\tau(s)$ since the weight factor and the reactivity density always occur together. μ is known as the *lump-sum consideration* , or lsc .

K is the amount owed to the hotel before the tenant fell into the hotel quagmire . When the debt goes below this amount, the tenant will be allowed to leave.

We define two *cross-section constants* b and c . b is commonly referred to as the *jump discriminant* , while c has often been called the

coefficient of inhibition . **bA is that part of the pressure on the tenant coming from the total accumulated debt that impels him to quit the hotel by any possible means, while cA expresses the sum of all paralyzing forces such as the tenant's perception of the strength of the landlord's refusal to allow him to leave, the difficulties of knotting a sheet or hiring a horse-cart, etc. .**

The constant β = b-a measures the *net debt pressure parameter* **, or NDPP.**

We wish to calculate the TDP , *total desperation pressure* **, Δ^*P on the tenant. We assume that if Δ^*P goes above the critical ζ (See page 8) , the tenant will try to sneak away , but that if it remains below this value, he will stay. Δ^*P consists of two parts: the NDPP ,** *coupled with a term that is proportional to the rate at which the debt is increasing* **, αdA/dt. α is often called the** *panic factor* **(PF) . Thus**

Δ^*P = (PF)dA/dt + (NDP P)A , or

$$^{\Delta}*P = \alpha\frac{dA}{dt} + \beta A$$

$$= \alpha\frac{d(\rho t - \mu(t) + K)}{dt} + \beta(\rho t - \mu(t) + K)$$

$$= -\alpha\omega(t)\tau(t) - \beta\mu(t) + \beta\rho t + \theta, where$$

$$\theta = \alpha\rho + \beta K$$

The constant θ can be adjusted to zero, it being observed that desperation pressure is always relative to the ground level from whence springs . This gives an expression for K ,

$$K = -\alpha\rho/\beta$$

The total accumulated debt is equal to the net debt pressure times the duration, minus the lump-sum consideration , plus the initiator.

The desperation pressure is equal to : minus the panic factor times the product of the weighting factor and the reactivity, plus the net debt pressure times the total accumulated debt.

The net debt pressure is equal to the jump factor minus the of inhibition .

The initiator is equal to minus the net debt pressure parameter times the predetermined incremental multiplier, divided by the net debt pressure parameter.

Imagine that a friend of the tenant, a mathematician in residence for a year at the *Institut des Hautes Etudes Scientifiques* , has been summoned to advise him . Like any medical doctor , his first concern is to stabilize the condition of the patient. He therefore wishes to keep the desperation pressure constant at a certain level, say λ . He solves the differential equation:

$$\text{[E]} : \alpha \frac{dA}{dt} + \beta A = \lambda$$

where the constants, α ,β and λ may be taken from the initial conditions. The solution to [E] can be found in any textbook on first-order differential equations, and is given by

$$\text{[F]} \quad A = \mathrm{Re}^{-\frac{\beta}{\alpha}t} + \lambda/\beta$$

where R is an arbitrary maneuverable constant

Since

$$A = \rho t - \mu(t) + K$$

we can solve for the lsc, μ , to get:

$$\mu(t) = \rho t - \mathrm{Re}^{-\beta t/\alpha} - \delta, where$$

$$\delta = \{(\alpha\rho + \lambda)/\beta\}$$

One sometimes sees the term 'latent reactive potential' (lrp) , used for the constant, δ .

If the lsc is equal to , or greater than this function, the desperation pressure on the tenant will either remain the same or fall. The arbitrariness of the factor R is striking. It means that there is a margin of choice: either the reactivity can be taken to be very small in the beginning, in which case it is compelled to rise rapidly; or it can start fairly close to ρt, then be augmented by small amounts. If the tenant is clever enough, he can arrange so that he is always paying in just slightly less than the

predetermined incremental multiplier, while still lowering the desperation pressure.

There is a school of thought which claims that the primary factor in the desperation pressure is the rate dA/dt at which the debt is mounting, and that the actual accumulation A is of only secondary importance. Certain landlords will be appeased, at least temporarily, if they see a greater amount coming in each week than the previous, and not notice right away that the total debt is rising. The formula that has been proposed is:

$$\Delta * P = \frac{dA}{dt}(\iota A^2 - \varepsilon A)$$

where ι is the climb slope and ε is a modified coefficient of inhibition.

This formula has been derived empirically: it had been observed by clinical social psychologists at the Medical School of the University of Michigan that whenever the rate at which medical bills rose was doubled, the increase in the number of heart attacks also doubled. They concluded that dA/dt ought to be a multiplicative factor. The second part of the right hand side of the formula was derived by treating the debt itself as a kind of amplitude. The desperation pressure can be interpreted as an intensity, which varies as the square of the amplitude.

This formula was extensively tested on rats. They were punished for poor performances in negotiating labyrinths by being kept cooped up in their cages for long periods , during which time their noses were tweaked by electric prods . The dosages, in watts, were proportional to the square of their misconduct. Then their physical and psychological reactions were measured with an electroencephalogram. The results were very close to the predicted values, after several dozen irrelevant factors were eliminated.

Setting the desperation pressure once more equal to some reasonable value, λ , we find that

$$\text{[G]: } \frac{\iota}{3}A^3 - \frac{\varepsilon}{2}A^2 = \lambda t + h,$$

h being an arbitrary constant that relates somehow to the general state of disarray of the tenant before checking in at the hotel. This equation gives hope, for we see that if the debt rises slowly, as the cube root of the time, then the stronger panic factor dA/dt will visibly decrease. In fact, Δ*P will eventually level out to a steady state. All of this can be summarized as :

If the payment structure falls off from the rent as the cube root of the time, the coefficient of

proportionality being equal to 3 times the critical desperation pressure ζ divided by the coefficient of inhibition, then the debt can mount up indefinitely and the tenant can neither escape nor be evicted.

The proof of the above is left as an exercise for the reader.

ALAS!! Even under this model, there will always be an *Absolute Debt Ceiling* , ADC, or Ψ , above which, despite the lack of psychological tension, the management will either

(a) Put locks on the doors

(b) Go to small claims court, or even

(c) Have the tenant arrested

A clever tenant will therefore know the value of Ψ , and use it to calculate how long he can stay on before the inevitable Γ -point.

(i) The coefficient of inhibition , ε

(ii) The ADC, Ψ , usually a rigid or fixed idea in the mind of the hotel ownership.

(iii) The critical desperation pressure, ζ

Ingenuity must ultimately exhaust itself . These situations have been around for thousands of years and people still seem to be unable to find any way out of them. The real world is not comprehensible by the unaided intellect, for it remains true , even in the last decade of the 20th century, when we can send people to the moon and store information at the quantum level, that a human being lacking a piece of green paper with a 20 printed on it can die in the streets of hypothermia. This is not the fault of landlords; nor of tenants. The blame lies rather with the incorrigible Evil festering in the bone marrow of the soul.

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